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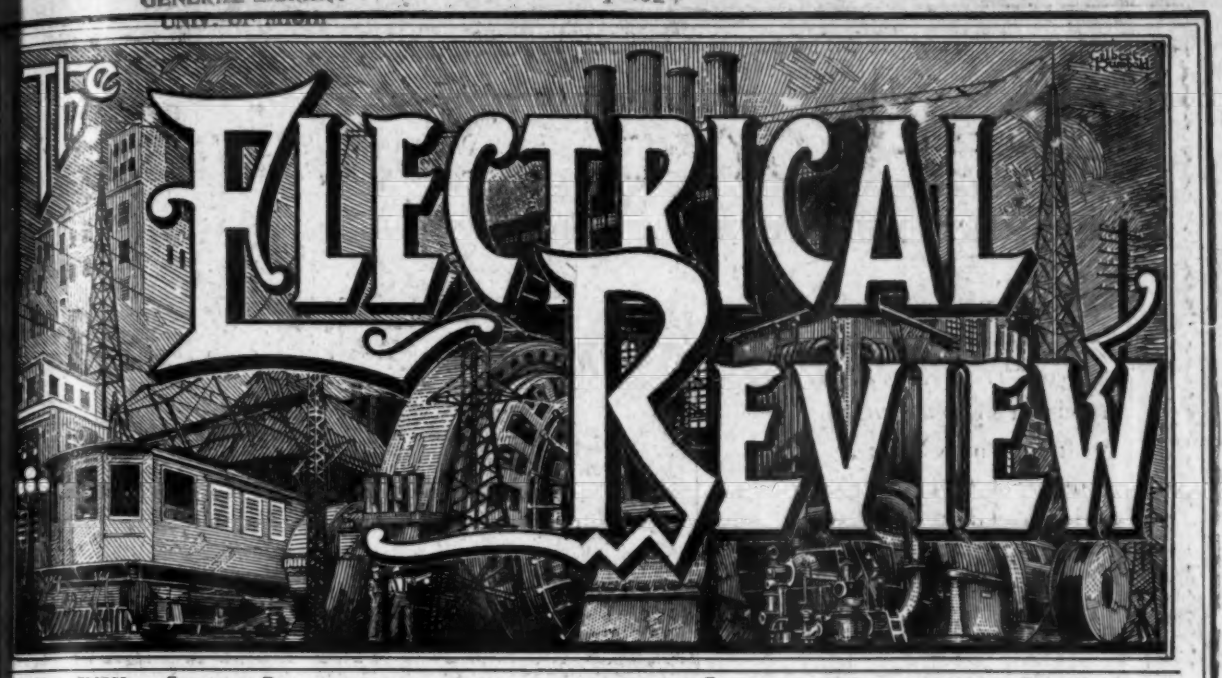

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Advertisement Index, see page xliv. *Official Notices, see Sup. 32.*

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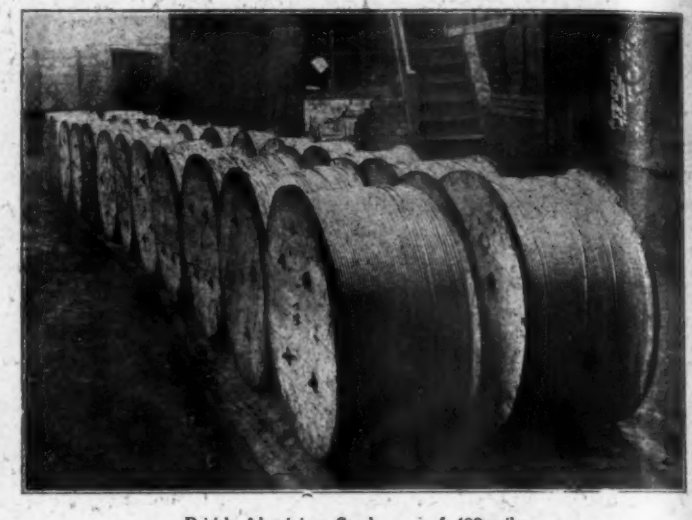

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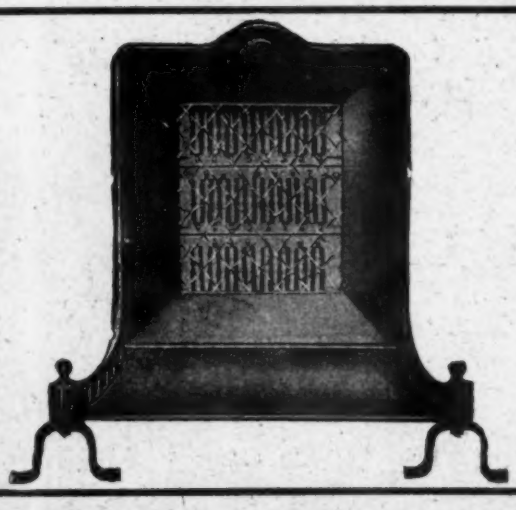

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ELECTRICAL REVIEW.

VOL. XCIII. DECEMBER 28, 1923. No. 2,405.

ELECTRICAL REVIEW.

Vol. XCIII.] CONTENTS: December 28th, 1923. [No. 2,405.

	Page
On Making Progress	961
Salesmen's Thoughts	962
An Appeal to Individuals	962
Business Bribery	663
Postal Rates	963
Hydro-electric Development in South America	963
The E.H.P. Conference	963
The British Empire Exhibition	963
Electric Railways in Italy, by Prof. F. A. Shepley (*illus.*)	964
Extra-high-pressure Transmission Lines, by R. Borlase Matthews (*illus.*) (*concluded*)	967
A Miniature Water-power Installation, by D. C. Miller (*illus.*)	969
Advertising in the Electrical Industry	972
The Evaporation Unit	973
Legal	973
Correspondence—	
Petrol-electric (Battery) Propulsion	973
Delayed Deliveries	974
Miners' Electric Safety Lamps	975
Recent Tendering for Electrical Contracts	975
Business Notes	975
Notes	984
City Notes	985
Stocks and Shares	987
Market Quotations for Chemicals and Metals	988
A General Formula for Calculating the Temperature of Electrically-heated Wires (*illus.*)	989
Electrical Prospects in India, by Philippe E. Peronne	990
Controlled Adjustable Illumination (*illus.*)	991
The Hydro-Electric Department of Tasmania (*illus.*)	992
Electrical Imports of British Malaya	993
The Emmet Mercury Boiler (*illus.*)	993
Ellison Hand-operated 6,000-V Switchgear (*illus.*)	995
Modern Transformer Construction	996
New Electrical Devices, Fittings, and Plant (*illus.*)	997
Reviews	998
New Patents	1000
Published Specifications	1000
Contractors' Column	Advertisement page xxx

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ON MAKING PROGRESS.

WE are afraid that there always will be some good people in the electrical world who will lag behind. No doubt they serve a useful purpose of some sort—if it is only to form a tail to the procession of those who are anxious to be ahead and well ahead—but unfortunately they may act as a drag and needlessly slow down the pace of the more energetic. Yet it is so much out of keeping with electricity that its votaries should go slow or be behind the times. The majority of us want to see rapid progress made in all departments of electricity supply so that the consumption *per capita* in the United Kingdom may more nearly approximate to that obtaining in some other parts of the world. We are making progress—of course we are!—but could we not accelerate the pace? There are, as there always have been, conditions and difficulties here that do not obtain elsewhere, but those conditions and difficulties could be dealt with more thoroughly if there were no obstructionists. We may listen with interest to the characteristic expressions of critics from across the Atlantic and to the frank and friendly advice of some of our Colonial kinsmen when they come to London. Sometimes we profit from their observations and do our bit to influence somebody else to get a move on; on other occasions we regret that hurried conclusions should be based on an incomplete understanding. But the critics from overseas we can bear with, for their views encourage introspection. It is the stick-in-the-mud type permanently within our gates that we cannot abide. Even the Press comes up against him occasionally, and all too painfully do we have proof that the spirit of electrical progress does not pervade all the officials and employés of some businesses and undertakings. Fancy, for instance, an official of an important undertaking when asked for a copy of a document of public interest replying to the editor of an electrical journal that he did not see why he should be bombarded by all the papers!

There is something to be said for the idea of "everybody sticking to his last," but we are not going to achieve the maximum success if we are lacking in adaptability and in the spirit of accommodation. There is no room in general electrical progress for the narrow conceptions of a trade unionism which prevents one employé from touching another piece of work because it does not lie within the compass of his particular craft. Let us have organisation by all means—efficient organisation, but do not let us organise personal initiative and enterprise out of existence.

Electricity is likely to go ahead in all directions far more rapidly if the generally-expressed desire for development is accompanied or followed by consistent action. Unfortunately there are electrical undertakings which we believe are more or less asleep even in these days—their inertia is astounding. Those whom this cap fits need not wear it long if there be the will to serve the general cause of electrical progress. Cheaper electricity would bring increasing business to practically every department of the industry; to keep the charges high is a short-sighted policy for those responsible, and it prevents the flow of business for others from increasing in volume.

The foregoing may apply to individuals, to trading firms and companies, or to electricity supply companies, but it has no limitation which prevents its application to sectional organisations. These, like private parties,

have to recognise the need for the spirit of adaptability and accommodation to changing conditions. We want to see great headway made in electrical applications by the community at large during the coming year. If existing policies and practices stand in the way of the best progress they should either be scrapped or else amended to meet the changing views apparent in the nation. Everything in reason should be done to make it easy for the public to make full use of electricity. It has proved abundantly that it can be a faithful servant of poor and rich alike. The "article" itself is its own best advertisement. One satisfied consumer makes many inquirers and practical demonstration is worth volumes of printed publicity matter.

When men talk of the three parties at Westminster, each of which protests that it will go its own way, it reminds us somewhat of the three-party position in the electrical industry. Why cannot we pull together for the well-being of the industry? Two of the programmes of the politicians showed a will to take the electricity supply industry under their wing as a means of making work—one offered cheap power supply and the other a national system of electrical power supply. These are old and meaningless cries when used by politicians. The electricity supply industry as it stands to-day under the Electricity Commissioners, needs no grandmotherly assistance so that it may be made to yield political kudos. It has inherent powers for vast expansion if those connected with it are enthusiastic about their work.

We are coming round to the view that it matters little who does the work so long as it is well done. Perhaps it matters less than we sometimes think who supplies the material to the public provided it is sound and reasonably cheap. What does matter very much indeed is that the facilities enabling the public to put in and maintain their electrical installations should be as good as or better than those afforded by gas undertakings.

Electrical installation costs need to have closer attention than ever. If we can reduce them to the minimum without undercutting (and therefore either giving bad work or going into bankruptcy) we can hasten the rate of progress, we can increase the orders for the manufacturers who in turn can reduce their prices by mass production, and we can help materially to render the British market independent of cheap foreign supplies. Where, at present, does the great difference between the price charged by the manufacturer and that paid by the consumer go?

Are we dangerously heterodox? Let us end the old year and begin the new with the determination that greater progress shall be made, whatever the cost.

Salesmen's Thoughts.

The persistence with which electrical men discuss the electrical Press is flattering, and we welcome it because it reveals the opinions held concerning it by those who are supposed to be detached from it. But while this is so it seems to us to suggest the lack of commercial development topics upon which men are prepared to write papers or to introduce discussions. In the discussion which is briefly reported on another page of this issue a number of interesting ideas are expressed.

Some of them we seem to have heard before. A prominent speaker who has long been eager for co-ordination to exist among the contractors, and for one association to represent them all, looks similarly with longing eyes towards the electrical journals as a direction in which there should be more co-ordination and only one journal, and that a good one, as though there were not a good one, and more than one, already! Amusingly enough he overlooks the fact that the E.C.A. so little agrees with him that it calls upon the industry to maintain one more. The reference to greater co-ordination is singular at a time when the self-same tendency in the daily Press is being widely condemned.

Then again as a contractor he holds that somebody else—the manufacturer—should be responsible for advertising electrically in the newspaper Press because he reaps the benefit; but that position is untenable when the advertising brings benefit also to the contractor. There is room for a more co-operative spirit here. Another view—that of the go-ahead electric supply man as represented by Mr. L. L. Robinson, of Hackney—is that no advertising pays so well as local advertising by supply authorities; but by local advertising he means something more than announcements in the local Press. The existence of his department is announced in many parts of the borough wherever the staff is doing work, and the telephone number, with its suggestion of immediate attention, is prominently shown. He is a believer, too, in big and central showrooms—and so are we—and that is a very important item in local advertising. Perhaps Mr. Robinson will tell us in detail one of these days how far the existence of his contracting staff is responsible for his success. The discussion led Mr. A. C. Morton to make an interesting comparison between the Electrical Review and a transatlantic journal, but his remarks require a little explanation. There is only one paper in the States to-day which in character is comparable with ourselves, and in its official claims it has a circulation of just over 20,000, not 30,000, against the over 13,000 that is given as our own figure. Yet the United States has a much larger electrical industry, and has 10,000,000 wired homes, while here we have only 1,000,000. The speaker deduced from these figures that the technical Press here had a larger reading public in proportion to the state of electrical progress than have similar publications across the Atlantic. No comment on this noteworthy point is needed excepting that we are not sure whether the difference between "readers" and "circulation" is generally understood. Those who know the position from the inside have grounds for estimating that on the average every copy of such a publication as our own is handled by three readers. While some copies rest with the one subscriber, others are passed in the course of study in offices or works through the hands of half-a-dozen or a dozen men and women.

An Appeal to Individuals.

It is encouraging to see at a time of year when the reverse was expected a steady decrease in the number of persons registered as totally unemployed. The last available figures (December 10th) show a decrease of about 1.2 per cent., or, since the beginning of the year, a decrease of 20 per cent. The fact remains, however, that the total remains at well over a million, and this takes no account of those who for various reasons are not on the registers of the unemployment exchanges. The figure is also augmented by the dependents of the unemployed, and it is apparent, therefore, that an extremely large section of our population is suffering and the rest of the nation is heavily burdened while human life is wasted.

Much is being done nationally and locally to find work for these men (and women), but we think that much might also be done *individually*. We are reminded of this by a circular letter which we have received from the National Painters' and Decorators' Joint Council. This points out that unemployment in that particular industry is peculiarly acute during the winter months owing principally to the inclemency of the weather, but this should not debar the carrying out of interior decoration, and the Council appeals to individuals not to postpone such work until the spring, but to have it done at once.

Of course, all trades connected with the building industry are governed by conditions peculiar to that industry, and such an appeal has less chance of success in other trades. It is possible, nevertheless, that in our own industry there may be this seasonal "hanging back" on the part of prospective customers, and we would urge contractors who find any falling-off in their business to adopt as their slogan, "Don't wait for the spring—electrify now."

Business Bribery.

Perhaps the festive season is not an inappropriate occasion on which to draw attention to the appeal for support issued by the Bribery and Secret Commissions Prevention League, Inc., in its News-Sheet just received. During 1923, we are assured, the League has been exceptionally active, but it will be obliged to curtail its operations unless more members are enrolled and more money is forthcoming. It is stated that only 21 new members have joined the League during the present year; this is less than a fifth of the number joining in twelve months when trade is prosperous, while, in addition, the wastage, inevitable in any organisation, is not being made good. In the insurance world, statistical records kept over lengthy periods show that fires increase in number when trade is bad, and decrease when it prospers; the most innocent amongst us suspects why. Are we to believe that the practices of bribery and corruption are necessarily more rife when trade is depressed? It may be so, the disposition to show a reduced standard of integrity being more common when competition to secure business is keenest. If such be the case, the need for supporting the League is the more urgent. We feel that lack of interest is partly to blame for its needy position, and the fact that most people and concerns have to look carefully into their extra subscription lists nowadays may also have something to do with the matter. Be the reason what it may, however, the objects of the League are deserving of every encouragement, and we commend it to the sympathetic consideration of all who wish to have a hand in maintaining a high standard of integrity in British commercial, industrial, and professional life.

Postal Rates.

It is as well to remember that there are certain non-controversial matters upon which all should be able to concentrate while statesmen and politicians are seeking a way through the three-party maze. The Post Office, like the Foreign Office, ought to be conducted on strictly non-partisan lines for the good of the whole country. At all events, the subject of postal charges is one affecting everybody, and it bears directly on our trade and industry both at Home and overseas. The Association of British Chambers of Commerce is holding a special conference of delegates from different parts of the country next month to consider the question. There is a pressing need for the restoration of penny postage, and the conviction is held that the immediate increase in correspondence of all kinds would both make more work for postal employés and prevent any great loss of revenue. Add to these the freer flow of trade that increased communications would promote, with the consequent increase in income tax, and the wisdom of the change would appear to be abundantly proved. But there are other points to which the Chambers of Commerce are giving attention, such as rates for postal samples—part-promoters of foreign trade—to and from this country; times of collection and delivery of letters in business districts; and certain anomalies that it is sought to remove. We hope that whoever has to deal with such questions at St. Martin's le Grand or at Westminster will take the broadest and most far-seeing view of the whole matter.

Hydro-Electric Development in South America.

Some indication of the scale on which electrical and financial concerns in the U.S.A. intend to operate in South America is contained in reports from the New York correspondent of *The Times*. The American and Foreign Power Corporation is being formed with an ultimate capital of $50,000,000 to develop hydro-electric power on an enormous scale, its field of operation being South America in particular. The U.S.A. company will come abroad for some of the capital, for it is stated that its shares will be offered for subscription in Great Britain, France, Switzerland, and Holland, as well as in the United States, but it is intended to hold the controlling influence in the States. It is remarked that the General Electric Co., through its subsidiary, the Electric Bond and Share Co., is at the back of the enterprise. The latter company is already interested in a great number of public utility enterprises in the United States and in foreign countries, and the new Corporation will take over from this company public-utility companies in 38 communities in Cuba, Panama and Guatemala. It is recognised that the present is a singularly opportune time for acquiring foreign enterprises at a low cost owing to the depreciation in foreign exchanges.

The E.H.P. Conference.

At the conclusion of the Paris Extra-High-Pressure Transmission Conference, a few of the principal delegates had the honour of being presented to the President of the French Republic, M. Millerand, at his official residence. The presentation took place on a bright and sunny morning, which assisted greatly in making a good impression of the Palais d'Élysée and its fine gardens upon the visitors. The British representatives, who were presented first of all the nations represented, were Messrs. W. B. Woodhouse (chief delegate), P. V. Hunter, R. Borlase Matthews, Arch. Page, and E. B. Wedmore. Dr. van der Bijl, of South Africa, was also presented. The fact that Great Britain was privileged to have so many of her conference representatives presented was undoubtedly due to a tactful request of the President, who seems most anxious to do everything in his power to maintain the *entente cordiale* between the two countries, both directly and indirectly.

M. Millerand has a much wider view of the possibilities of electricity than the average politician or municipal official, and looks upon it not as a thing in its infancy, but rather as an established factor of some fifty years' standing, which is already greatly ameliorating and facilitating life in rural districts. In point of fact—like many other Continental States—the French Government is taking steps to see that in the near future every farmer and country dweller shall have a supply of electricity available; the President emphasised this very clearly in the speech he made to the delegates.

The British Empire Exhibition.

In four days from to-day we shall be in 1924—the year of the greatest exhibition in the world's history. Countless millions of visitors will pour through its gates in quest of entertainment and instruction, with their minds in receptive mood, eager to *see* things. That is the essence of an exhibition—the whole reason for its existence—to enable multitudes to *see* the latest inventions, the newest appliances, the most modern methods, in every walk of life. Nothing of the kind has been done for ten years; visitors will come not only from all parts of the British Isles, but from the ends of the earth. Are we all doing our utmost to make the best possible use of the opportunity to promote the revival of British industries in general, and the electrical industry in particular?

The electricity supply industry, too—does it fully realise what a magnificent chance this exhibition affords for the rapid development of the demand for electrical energy? Thanks to the foresight and initiative of the Electrical Development Association the uses of electricity for lighting, power, domestic, and commercial purposes, are going to be demonstrated in a manner, and on a scale, never before attempted and, we believe, with an efficiency never previously approached.

The E.D.A. enclosure will be the electrical centre of the exhibition, and the lessons that it will teach will bear fruit in every electricity supply area in the country. Is it too much, then, to expect every undertaking to share in the expenses? To withhold support from so sound a proposition would not only be unworthy, but it would be folly. The greater the support received, the better will be the show, and the time to give it is *now*. Only by so doing can the full benefit of the enterprise be realised. Here is the greatest electrical showroom in the world—let it be *your* showroom!

ELECTRIC RAILWAYS IN ITALY.

(By a Special Correspondent.)

Italy in the past has been celebrated for its art, its priceless literature, its wealth of song, its gorgeous architecture; but the Italian of to-day is of much sterner stuff, and aspires to be recognised for his industry, his engineering skill, his commercial capacity. He desires to take his place among the great ones of the earth.

Mussolini is the high priest of this new cult, and is providing the energy whereby Italy is to achieve greatness. With the advent of Mussolini, the factories began to work, the electrification of the railways—instead of being talked about—was brought within the range of practical politics. It is now but a question of ways and means, and it will not be long before Italy becomes a land of cheap transport and cheap power.

The first experiments on the electrification of main lines in Italy were based on three different systems:—

1. In February, 1899, the Milan-Monza line—17 kilometres long—was inaugurated with a system of accumulator traction, and in 1901 a further trial of this system was made on the Bologna-St. Felice line. Though technically the experiments were successful, the growth in the traffic to be handled made it imperative for another system to be devised.

2. This led in the year 1901, on the Milan-Varese line—60 kilometres in length—to the trial of the third-rail system with 3-phase, 16-cycle current at 3,400-4,000 volts. The Lecco-Colico-Chiavenna lines (106 kilometres) were also electrified with the third-rail.

3. The Valtelline lines experiment adopted 15-cycle frequency with the object of diminishing the voltage drop and simplifying the transmission. The pressure at the trolley was established at 5,000 volts, at that time considered very high indeed.

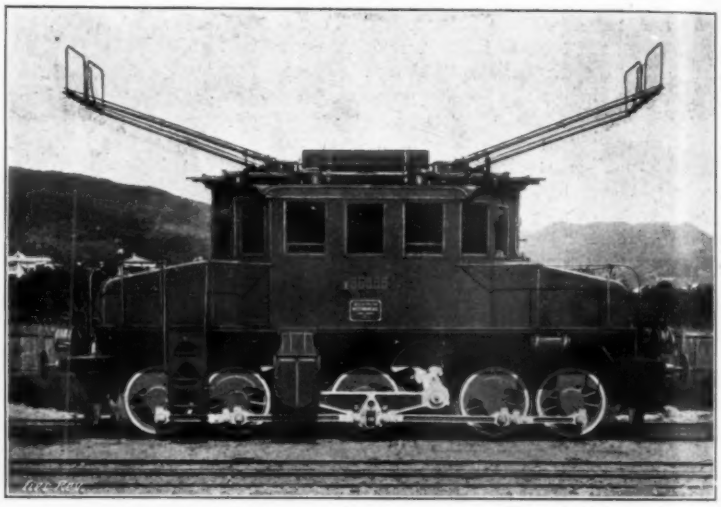


Fig. 1.—Brown-Boveri Locomotive, Type E 550.

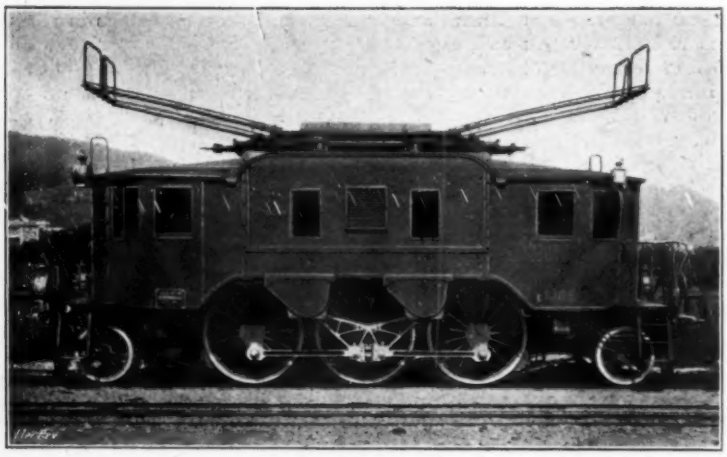


Fig. 2.—Brown-Boveri Locomotive, Type E 330.

From 1910 to 1914 the two Giovi lines, which hold the heavy traffic record for Italy, were electrified. These lines cross the Apennines, one with a gradient of 7 in 20 and the other of one in four. The Giovi lines are important, for they connect up with the port of Genoa *via* the Ceva-Savona line and the Savona-Genoa line, electrified in the year 1916.

Another line which is of great importance is the Modane-Bussoleno, which tunnels through the Alps for 13,600 metres at 1,260 metres above the sea level.

Turin is destined to become a great centre in the Italian system, and in anticipation of this fact the Turin-Pinerolo line was electrified in 1917. Further progress was delayed by the war, and it was not until towards the end of 1919 that there were exploited the Turin-Bussoleno and the Bussoleno-Suza lines (63 kilometres, of which 45 km. is double track).

The political unrest immediately following the war interfered greatly with all work, especially with electrification. The new Fascist Government has given the requisite stability, and now old schemes and new ones, too, are being pushed forward. The Voghera-Alessandra, Tortona-Novi, and the Tortona-Aquata lines will shortly be in full running order. (Those who served with the British Expeditionary Force in Italy will remember these places, especially the men who were invalided.) In March, 1921, work was begun on the following:—Genoa-Pisa; Bologna - Pistoia - Florence; Bologna - Faenza - Pellice; Brichorasio-Pargo; Rome-Tivoli; Rome-Cerano-Netturno lines.

The Genoa-Pisa line (176 kilometres long with 400 kilometres of track) is urgently needed to overcome the coal crisis due in part to the occupation of the Ruhr, and to cut staff expenses.

The Bologna-Pistoia-Florence and the Bologna-Faenza-Pellice lines have both long tunnels and steep gradients. The traffic limit has been reached on these lines under steam, and the only solution for increasing the traffic is to electrify them. These lines total 283 kilometres, with 546 km. of track. It is estimated that 100,000 tons of coal will be saved per annum.

Of the 1926 scheme, there still remains about 4,496 kilometres to be electrified. Gradients and heavy goods

traffic have been specially considered, since coal consumption is a very grave question for Italy, being, as she is, entirely dependent upon other countries for all supplies. By the new project, it is estimated that 250,000 tons will be saved annually, which will effect an economy of many millions of lire. To replace this coal, 600 million kWh of electrical energy will be required.

In addition to these State lines, there are 200 kilometres of normal-gauge secondary lines and roughly 500 km. narrow-gauge, all belonging to private enterprise.

Power Production.

The power for the Piedmont and Ligure lines is obtained from the S.F.I.M. (Società Forze Idrauliche della Maira) on the Maira Torrent and from the central station at S. Dalmazzo sur le Roia. The hydro-electric power at 16 to 17 cycles at the disposition of the above stations is as under:—

		kW.	Total kW.
Prazzo Central Station	(normal)	12,000	
	(reserve)	6,000	
			18,000
Acceglio Central Station			12,000
S. Dalmazzo Central Station			
	(normal)	15,000	
	(reserve)	5,000	
			20,000

To this must be added a steam reserve, belonging to the State, of 19,000 kW. The Italian State Railways have also constructed two hydro-electric stations at Bardonecchia for the production of 19,500 kW, with 6,000 kW as reserve. The Government's policy is generally to obtain its power from private companies, but to have at least one station of its own in each zone in order not to be too dependent upon these companies. It is estimated that there is about 2,500,000 h.p. (hydro-electric and steam) available, but when the new works, which are in hand, have been completed, this power will be greatly increased. One station alone in Sardinia soon to be opened will produce 30,000 h.p.

Further electrification is in course of study, *viz.*, the Milan-Bologna-Parma-Spezia and the Pisa-Florence lines which, when finished, will join up the networks of Lombardy and Piedmont with those that are being gradually formed south of Bologna. Other work belonging to the scheme is the electrifying of the following:—Voghera-Milan-Chiasso; Usmate-Bergamo; Colozio-St. Pietro; Verona-Brennero; and Triest-Piedicollo lines.

Here, again, the power will be supplied by private companies, but the Government, adhering to its usual policy, will construct one generating station in each zone, which will run in parallel with those of the companies.

Some of these stations are already in hand:—

(1) The hydro-electric installations on the Reno Torrent and on the Limentra Torrent, to the south of Bologna. These fall within the inner electrified ring—Bologna-Pistoia-Florence-Faenza-Bologna.

(2) The Suviana and Castrola generating stations will have a two-fold scope: to supply both the railway and the factories within the effective radius.

(3) The Sagittario installation, near Sulmona in Central Italy, will produce 25,000 h.p.

The first group will provide some 52,000,000 kWh annually. When the upper reaches of the Reno Torrent have been fully exploited, the output will exceed 200,000,000 kWh yearly.

Three-phase Traction.

As stated before, the Milan-Varese and Ponte-Ceresio lines use the third-rail system at 550 volts, direct current. These are the only d.c. lines in operation in Italy. All other State lines are constructed on the 3-phase system at 3,400-4,000 volts, low frequency (15 or 16.7 cycles).

Power is generated directly at low frequency by mixed generating stations or by stations equipped for this frequency alone. Private companies always generate at double frequency, sub-stations converting the power to low frequency.

In the first case the central stations and the main transmission lines are devoted exclusively to the use of the railway, for it is not easy to exchange power between the different primary networks without having recourse to rotary-transformer equipment. A further objection to generation at low frequency is that, with every extension of the railway, new main transmission lines must be laid, and, as these lines usually follow the course of the permanent way, they are not always available for industrial use. The voltage drop, however, is less when the power is generated at the 15-cycle frequency than at the 50-cycle frequency that is used for industrial purposes.

As the voltage drop is less at low frequency, the transmission lines may be of smaller cross section and lighter, for the impedance of a 7-mm. wire at 16.7-cycle frequency is about the same as that of a 9.5-mm. wire at 50 cycles. Where long distances are to be served, such as Piedmont and Ligure, 150 kilometres from the supply station at the foot of the Alps, this is of extreme importance. By means of stations equipped with the necessary alternators for two frequencies, it is a simple matter to chance over from one frequency to another, and only one reserve line is required.

The S.F.I.M. transmission lines with this system can supply power as far as Genoa at 50 cycles or at 16.7 indifferently.

The use of 42- and 50-cycle periodicities is general in Northern Italy, the conversion being made by synchronous or asynchronous motor-alternator groups. This grouping is in great favour in Italy, as it is characterised by suppleness and elasticity.

Transformer Stations and Contact Lines.

In the early attempts at electric traction in Italy, *viz.*, the Valtelline and Giovi lines, transformer stations were set up along the track about 10 kilometres apart. Consequently, the trolley line wires had only small cross sections, 50 mm.^{2}, with a maximum of 100 mm.^{2}, for steep gradient trunks. At that time such a sub-station cost about 10,000 lire to maintain, but now, owing to the reduced hours of labour and high wages, the cost has increased more than five-fold; that is to say, it is between 50 and 60 thousand lire per year.

To overcome this enormous cost of running, portable sub-stations have been introduced in place of the static sub-stations, which offer the advantage that when there is a call for a concentration of power at any one point in the electrified system, these portable sub-stations can be run there without loss of time. From this it will be perceived that primary transmission lines are necessary everywhere along the line, a system that Italy has followed in her line construction throughout.

Locomotives now allow of a pressure drop at the trolley of as much as 35 per cent. of the light-load pressure; that is, the pressure may vary between 4,000 and 2,600 volts. On lines of a certain importance it is necessary to have a section of contact conductors for each aerial phase of not less than 200 mm.^{2} both for mechanical reasons of stability and for rigidity of the line at high speeds. With a cross-section of 200 mm.^{2} per phase, the distance between transformer stations, on lines of heavy traffic and low gradient (about 10 to 11 in 100), can be extended to 35 kilometres. By the introduction of suitable feeders, this distance can be still further increased. For instance, the Sestre Levante station on the Genoa-Spezia line will be situated 45 kilometres from each of these cities.

The 3-phase contact system requires two overhead conductors, insulated from each other, the third conductor being constituted by the rails. The insulation between each wire and the rails is tested at 30,000 volts. No difficulty has been experienced with regard to maintaining the insulation of the contact line, even on sea-coast lines such as the Genoa-Savona line, where previously much trouble had been caused by the salt driven across by the wind.

The insulation of the contact line is, in the later types of insulators, subdivided between four pieces of porcelain in the insulators for the aerial conductors.

E

By the subdivision of the insulation into elements, short-circuiting due to the rupture of insulators is avoided. The breaking of one or even two elements produces no danger at all, for one element alone remaining intact is sufficient to ensure the necessary insulation.

Electric Locomotives.

The Italian Government has voted some 116,000,000 lire for the purchase of 96 engines. The contract has been divided between the following Italian companies:

Ernesto Breda	23	Ansaldo	10
Officino Meccanico ...	15	Romeo	18
Brown, Boveri ...	22	Vickers, Terni	8

This works out at 1,200,000 lire per locomotive. However, both the chief engineer of Messrs. Ernesto Breda and the chief engineer of Messrs. Brown, Boveri have informed me that the real price is only a shade over one million, which, at to-day's exchange, *viz.*, 106 lire to the pound, cannot be considered excessive. These locomotives are light, strong, and economical, and, because of their simplicity, are easy to manipulate. The weight on each axle must not exceed 15 metric tons. On account of the steep gradients, it is highly important that the locomotives should not be too heavy, otherwise they involve too much useless dead weight. Below are the special characteristics of recent 3-phase types made in Italy: Model E 550 fór mountain lines and Model 330 for high speeds (see figs. 1 and 2, p. 964). The pressure is 3,000-3,300 volts.

Characteristics of Model E 550.

Traction motors ...	2.
Total motor power ...	1,570 kW.
Adhesion weight ...	60.1 metric tons.
Normal speed ...	45-50 km. per hour.

Characteristics of Model E 330.

Traction motors ...	2.
Total motor power at 75 km.-hour ...	2,000 kW.
Total weight	73 metric tons.
Adhesion weight ...	45-51 metric tons.
Length overall	11,008 mm.
Diameter of driving wheels	1,630 mm.
Diameter of bearing wheels	950 mm.
Length between end axles	7,400 mm.
Tractive effort at 37.5-50 km. per hour ...	9 metric tons.
Tractive effort at 75 km. per hour ...	9.5 metric tons.
Tractive effort at 100 km. per hour ...	6 metric tons.
Normal speeds ...	33.5 & 37.5 km. per hour. 45 to 60 km. per hour. 67.5 to 75 km. per hour. 90 to 100 km. per hour.

The characteristics of Model 350 are similar to those of E 330. The speed change is obtained by coupling the motors in cascade and by changing the number of poles.

The latest design of electric locomotive, the E 551, which has just been handed over to the State railways by the Tecnomasio Italiano Brown-Boveri, has the following characteristics:—

Characteristics of Model E 551.

Feed current	3 phase, at 16.7 cycles, 3,300 volts.
Traction motors	2.
Total motor power at 50 km. per hour	2,200 kW.
Adhesion weight	75 metric tons.
Weight fully loaded	75 metric tons.
Tractive effort	15 metric tons.
Speed	25-50 km. per hour.

The two traction motors develop some 1,250 h.p. each, and, as they never overheat beyond 75 deg. C., the horse-power available is close upon 3,000. Speed variation is effected by coupling the motors in cascade and in parallel. The angular speed at synchronism with the motors in parallel equals a maximum of 225-250 r.p.m. The power is transmitted to the central axle by means of a triangular connecting rod, standard coupling rods being used for the other axles. The locomotives are provided with two 12-kW transformers, which reduce the pressure to 110 volts for the accessory services.

There are four sliding bow contacts controlled pneumatically, all functioning at the same time. Electro-pneumatic drives are used throughout. For starting, a liquid rheostat is used, with water cooling.

In appearance model E 551 closely resembles E 550 (fig. 1). These locomotives are said to be the largest that have as yet been built in Europe.

Turin-Modane Line.

The following is a description of the line that connects Italy to France. If the "Douane" at Modane were as perfect as this line, travellers would have nothing to complain about.

The length of line electrified is approximately 230 km.; the maximum gradient is 3 in 10; and the minimum radius of curves 350 m. The system is three-phase, at 3,700 volts, 16-17 cycles, the section of the aerial contact conductors in each phase being 200 mm.² (2 wires of 11.3 mm. diameter).

Power is supplied either by the generating stations at Prazzo and Acceglio in parallel with the S. Dalmazzo generating station, all belonging to the S.F.I.M., or by the generating station on the Melezet Torrent at Bardonecchia, owned by the Italian State Railways. The power supplied by the S.F.I.M. is delivered at 60,000 volts at the Bussoleno and Sangone sub-stations, where it is metered.

The Bardonecchia generating station, which produces power either at 50 or at 16-17 cycles, is also connected up by the Chiomonte sub-station with the town of Turin (50 cycles).

The transformer stations placed along the line number five, all owned by the Italian State Railways, and are equipped with plant of 2,500 to 4,500 kW each.

Electricity versus Steam.

Here is the latest comparative table drawn up to show the difference in working between electricity and steam in Italy:—

Items of comparisor.	Steam traction.	Electric traction.	The group of the Ligure & Freyus lines electrified.
Coal on tender (248.46 lire per ton)	13.15		
Electric power for traction purposes	—	1.60	1.50
Engine staff, lubrication, repair, and water service	1.61	1.12	1.04
Upkeep of locomotives	1.22	0.80	0.62
Upkeep of electric installations ...	—	1.00	0.78
Depreciation and interest on prime cost of locomotives	0.64	0.77	0.63
Depreciation and interest on the cost of electric plant	—	1.42	1.13
General expenses for workmen's provident society, sick fund, &c.	0.42	0.45	0.37
Total	17.04	7.17	6.07

From the foregoing table it will be at once perceived what an immense saving is effected by the substitution of electric for steam traction. Furthermore, the more important the line is the greater is the advantage derived from the conversion. It is to be observed, too, that these calculations have not taken into account other factors of economy, such as less wear and tear of rails due to the adoption of electric brakes, no corrosion of metal work arising from sulphur dioxide exhalations, absence of smoke in tunnels, reduced upkeep of rolling stock, coal carts and cartage abolished, &c.

A careful survey of the work that is going on in Italy to-day should not be without its lessons for the British electrical engineer. Much of this work is possible because of the disorganised state of the markets of the world and because of the protective policy of the Italian Government.

Italy is a land of great possibilities in the near future, but the Englishman who wishes to share in these possibilities must lay himself out to study the market and supply the best and most exact article and not

the "nearest we can do." This policy will not do at all. It must be borne in mind that there are now FORTY MILLION PEOPLE in Italy; they present a grand opening for many of our electrical appliances, but their needs must be considered. England seems to be doing nothing there. Instead, Germany, though she cannot supply, is covering the place with agents who know their work and who are never tired of showing the beauty of their samples. They know that there is no possibility of obtaining orders, but they still peg away and are slowly, but surely, returning and, by their propaganda, are endeavouring to demonstrate the superiority of Germany to all other countries. The other day I was questioned as to what I considered would be the best thing to do. My answer was: "We have turned our sport into business; let us now turn our business into sport, and there will be no end of work for all, for in this lies our regeneration."

EXTRA-HIGH-PRESSURE TRANSMISSION LINES.

By R. BORLASE MATTHEWS, Wh Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(*Concluded from page* 932.)

Standardisation of Pressures.

THIS subject gave rise to considerable discussion. Apparently local conditions, the length of the lines and the density of the populations in the districts served, exercise a very considerable influence. All lines, however, are now being influenced by national and international policies. Nowadays, of course, group operation is all-important, as compared with independent working, which was previously the practice. An interesting curve was shown in a paper by Mr. F. C. Hanker, indicating the maximum distribution pressures in America as rising steadily from 20,000 volts in 1896 to 220,000 volts in 1923. There are now about 50,000 miles of overhead transmission in America operating at from 13,200 to 220,000 volts. Further, there are several systems at 44,000 volts operating lines metallically connected, each aggregating 3,000 miles. At 110,000 volts a number of systems operate 1,200 to 1,500 miles of interconnected circuits. American voltages are based on the factor 11, with multiples of 6, 8, 10, 12, 14 and 20.

The next steps are to be 330,000 and 440,000 volts. The original reason for the selection of the figure 11 as a multiple is based on the use of multiples of 10,000 volts at the generating stations, with 10 per cent. allowance for voltage drop.

M. Darrieus maintained that the American standard was rather arbitrary, as the voltage drop varied according to circumstances. Further, a decision was necessary as to whether the normal voltage should be given as at the generating station, or as at the end of the transmission line; he preferred the former. In any case, consideration had to be given to a suitable ratio for the supply of networks at two, three, and even four lower pressures. M. Darrieus gave an interesting comparative table of the transmission voltages adopted in various countries (see fig. 3).

A periodicity of 60 cycles is now standard in the United States, and 50 cycles on the Continent of Europe.

The Italian Electrotechnical Committee through M. Vannotti, pleaded for a more logical method of selection than the American, and suggested a ratio of 1 : $\sqrt{3}$; *e.g.*, if one stage was 20,000, the next should be 35,000. Also it considered that the jump from 110,000 to 220,000 V was too great, and an intermediate voltage of 150,000 V should be provided. Its recommendations were:—3,700, 6,400, 11,000, 20,000, 35,000, 65,000, 110,000, 150,000, 220,000, and 300,000 volts.

Protection Against Over-voltage.

Over-voltages on electric circuits are due to four distinct causes: (*a*) direct stroke of lightning; (*b*) induced charge due to lightning discharge or charged clouds; (*c*) gradual accumulation of static electricity, due to sand, sleet, hail, and snowstorms; (*d*) internal disturbances due to surges arising from switching, sudden load fluctuations, resonant conditions, arcing grounds or other causes inherent in the circuit itself. Direct lightning strokes are rare, probably due to the insulation of the lines and the fact that buildings, &c., offer a better

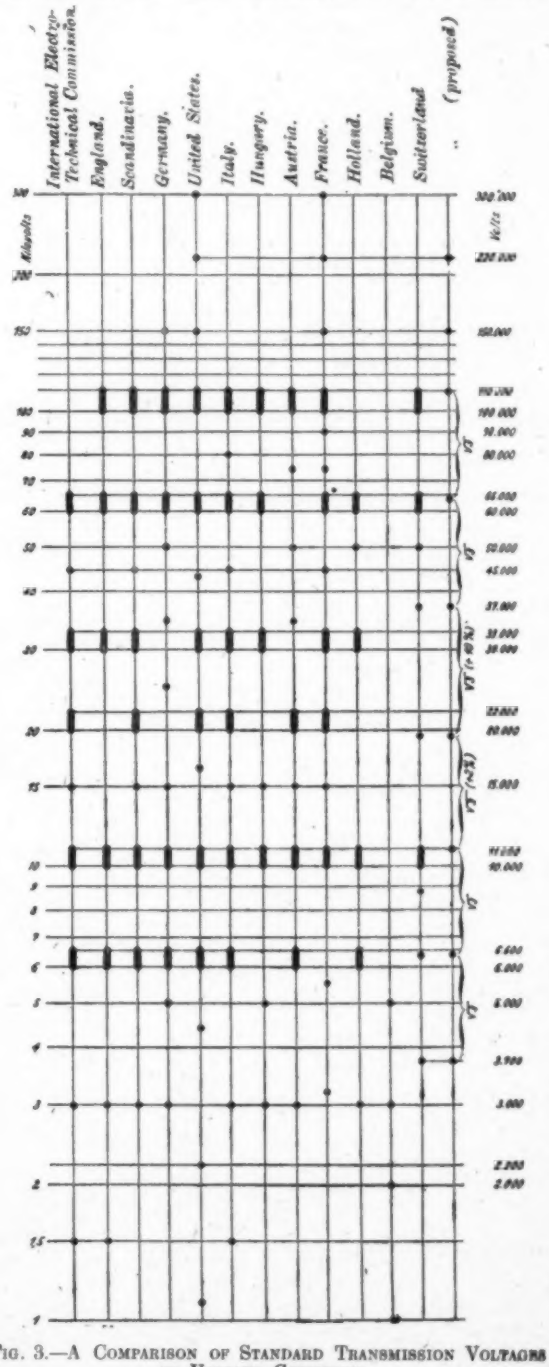


FIG. 3.—A COMPARISON OF STANDARD TRANSMISSION VOLTAGES IN VARIOUS COUNTRIES.

grounded electrode for discharge. Lightning, even if it does not strike directly, is responsible for very dangerous over-voltages on the circuits, due to electrostatic and electromagnetic induction. Of course, the best protection against lightning or lightning effects is to lay the transmission line as a cable. Internal disturbances, as yet, afford an unsolved and complex problem. In a paper by Mr. H. M. Towne, after a consideration of various methods of protection, the conclusion is reached that the oxide-film type of arrester embodies most of the desired qualities. During the past eight years it has become standardised in the United States, and is used very largely on the Continent. As is well known, the oxide film arrester acts on a valve principle. It has characteristics not unlike the electrolytic (aluminium) type of arrester, but has the great advantage that, unlike the latter, it does not require recharging. The self-restoring or sealing characteristics of the oxide-film arrester are obtained by utilising the property of lead peroxide to change rapidly from a low resistance to a very high resistance, when subjected to a temperature of 150 deg. F. (say 65 deg. C.) or higher. At normal temperature lead peroxide ($Pb O_2$) is a good electrical conductor, having a resistance of about one ohm per cm. cube, but with the application of heat, a chemical change takes place which reduces the $Pb O_2$ to a lower oxide of a very high resistance, which may be either red lead ($Pb_3 O_4$), sesquioxide of lead ($Pb_2 O_3$), or litharge (Pb O), depending upon the degree of temperature.

The arrester cells are constructed of two brass-plate electrodes, spun on a porcelain ring, 5 in. thick. The space within is filled with powdered lead peroxide. The internal surfaces of the electrodes are coated with an insulating varnish. Each of these cells has a rating of 300 volts effective. If the voltage is increased, the insulating varnish punctures in one or more minute points. The passage of the current and the consequent minute arc at these points changes the small portion of lead peroxide at that place to one of the other oxides, which therefore immediately offers a high resistance and interrupts the flow of current. This sealing action is very rapid, requiring less than one four-thousandth part of a second. Upwards of 60,000 discharges through a cell can take place without appreciable deterioration—the equivalent of many years of service. Owing to the rapid sealing action, the series gaps can be completely covered in, when used out of doors. The combination is practically fireproof. Choke coils are recommended as a supplement to the oxide-film arresters.

Earthing of the Neutral.

One of the three papers that aroused the most interest at the Paris Conference was that by Mr. J. R. Beard on the above subject. This is, of course, a practice that was adopted in England some years ago. Then, after some controversy, it became standard in America. On the Continent the principle has not yet been fully accepted, though in many cases the neutral is earthed in a flexible manner through a reactance coil. Mr. Beard pointed out that it was really a misnomer to talk of running with an unearthed neutral, as the system is really earthed through the star-connected capacities of the various phases to earth. Further, as much as 10 per cent. can be saved on the construction of a 30-kV line, and more on lines of higher voltage. It is not too much to say that the recent American 220-kV lines could not have been successfully operated unless the neutral had been definitely earthed. A number of convincing arguments were given to show why an earthed neutral was more satisfactory from the point of view of the electricity supply authority.

The subject was next considered from the aspect of the telephone and telegraph services. Then the advisability of multiple earthing of the neutral was discussed. This, of course, is contrary to British regulations at present, probably due to the fact that in early days the neutral was usually earthed at a generator. Generators invariably have some resultant third harmonic at the neutral, and undoubtedly any multiple earthing of generators at different parts of a system would result in third harmonic currents flowing through the earth, which would be very objectionable.

As a result of special representations to the Electricity Commissioners, a number of tests have been made in the North-East of England by the Post Office engineers and the power companies, to determine the actual effect of multiple earthing. Tests made with both single and multiple earthing confirmed that as long as the multiple earthing was confined to neutral points, which were in combination with a delta-connected secondary winding to eliminate third harmonics, the normal disturbance was negligible. Sanction has accordingly been granted in this particular area (1,500 sq. miles and 16 generating stations in parallel) for a limited number of multiple earths. The Pacific Gas and Electric Co. has over 150 earths on the neutral of its 110,000-volt system.

Technical Regulations.

A not unimportant advantage of such an international conference as that held recently at Paris is that some degree of uniformity in the technical regulations of all countries can be brought about. During the general conference several meetings were held of the various Government officials in attendance. The French, Belgian, and Swiss delegates presented comparative abstracts of existing regulations in various countries, together with suggestions for additions and alterations in accordance with experience. After all, many technical regulations issued by Governments are really due to fear—fear of the unknown, due to inexperience. "Safety first" is of supreme importance, but sometimes the precautions insisted upon are ridiculous in both cost and appearance. One of the reforms that, it is proposed, should be adopted in some countries is to provide legislation so that in crossing private land greater precautions need not be taken than are at present called for in Government regulations for public highways and the like—this method of insistence on the part of private owners is often really only another way of obstructing a power company. Proposals were put forward for dispensing with elaborate (and useless) cages on road and rail crossings, as safety wires which double the conductor at the crossing point have been found to be much more effective. Also it was suggested that there was no real need to divert transmission lines out of a straight run at road crossings, as is at present called for in some countries. In fact, fewer insulators and angle supports are needed, and hence greater safety is achieved on straight lines. Malicious breaking of insulators by the throwing of stones, &c., it is put forward, should be heavily penalised.

It is argued that the favourite practice of Government regulations, in changing the factor of safety of the lines at road crossings, &c., does not make the lines any safer, owing to the necessity for making joints, &c. Further, the tension of the wires should be constant throughout the line, hence a uniform factor of safety of 3, everywhere, is far preferable.

"Safety First" Education.

In the Netherlands the Safety First Association also deals with the precautions that the public should take in using electricity. Mr. J. G. Bellaar Spruyt read a paper on this subject. Posters are issued in the Netherlands which illustrate the dangers of domestic apparatus of faulty design—the points at which an electric shock may be anticipated are occupied by lurking, long-tongued, red dragons, the idea being that the sting is at the tip of the tongue. While the designs are doubtless very striking, most of those present seemed to think that slight inconveniences were rather exaggerated into dangers. Further, they would be rather apt to prove good propaganda for the gas company—unless possibly the Safety First Association has a still more terrifying set of posters about gas.

In Conclusion.

It is rather difficult to compress into a small space a complete summary of all the papers that were read and the discussions that took place on them during a week's hard work. These notes must therefore be regarded rather as an advance key to the volume of the complete proceedings that will be published in a few months' time. It is very difficult to obtain authoritative information about extra-high-pressure transmission lines. In fact, the only sources are a few scattered papers in the proceedings of engineering institutions, the published report of the first International Conference (of which but a very few copies, in French, are available), and the prospective report of the second Conference. The prices of these reports are thirty shillings each. Owing to lack of subscriptions, the first report was not also printed in English, as was intended; and the same fate will befall this year's report if insufficient subscriptions are received. Hence, it is up to those who are interested to send in their names as soon as possible to the secretary, Union des Syndicats de l'Electricité, 25, Boulevard Malesherbes, Paris. There are more than sufficient subscriptions to justify the publication in French—and yet there is a far greater number of English-speaking than French-speaking engineers who are associated with extra-high-pressure work.

Incidentally, all the English notes of the Conference were taken down by a stenographer, with the aid of a 21-key mechanical shorthand typewriter (the Stenotype Grandjean). This machine was capable of taking down 200 words per minute with ease, in legible, easily-read type-print, on a continuous roll of paper. Of course, the reading was phonetic, but it could easily be transcribed by anyone. The question is whether this enterprise is to be wasted for lack of orders for an English edition.

In connection with the Conference, arrangements were made for the delegates to visit any works they desired in France. Official visits took place to the new Gennevilliers power station (see Electrical Review, Vol. 90, p. 514, and Vol. 91, p. 89), which is already in a somewhat untidy and dirty condition; the new million-volt insulator testing laboratory at Ivry; and the new works of La Compagnie pour la Fabrication des Compteurs. The insulator-testing equipment was of such a novel character that it is worthy of a separate description. The meter works turns out nearly 1,500 electricity meters a day—a good indication of the rapid progress of electricity—in addition to a very large number of gas and water meters and radio apparatus. A novelty in the water meter-testing department was a large closed-ring water main, in which water could be continuously circulated, by means of an electrically-driven centrifugal pump, for testing the largest of water meters. This is the first installation of its kind. The company employs 3,500 men at these new works, with a total of nearly 8,000 at all its establishments. A visit such as this makes one realise the enormous sale there is for meters to-day. Their usual stock is 40,000 meters. A very neat single-phase house meter, largely used in Spain, was noticed. It combined a d.p. switch and d.p. fuses. Its adoption must economise much work in connecting-up small consumers, and one wonders why its use is not more widely spread—possibly it is little known.

This Conference has indicated that the world is well on its way toward the super-power systems that will ultimately tie together power sources a thousand miles apart and co-ordinate power from coal mines and waterfalls, and from watersheds of varied seasonal precipitation and flow. Thus, the universal Electrical Age is surely, even if slowly, coming into its own. Whole countries now have electricity available for 40 per cent. of their inhabitants, and very large sections of countries are supplying 80 and 90 per cent. Hence the vital importance of a careful study of the problems of Extra-High-Pressure Transmission.

A MINIATURE WATER-POWER INSTALLATION.

An 85-Volt 0·55-kW capacity Plant.

By D. C. MILLER.

The following details of a by no means pretentious, but none the less practical, miniature installation will, at least, indicate what can be done to realise the potentialities of a mere trickle of water, under favourable topographical conditions.

The "beck" which provides power in the present instance is situated on the mid-western fringe of the English Lake District and comes into being about one and a-half miles from the position of the plant, at an altitude of approximately 500 ft. above sea level. It does not, however, attain anything like its still tiny capacity at the dam until it is within about half a mile distant and at an altitude of approximately 350 ft. The general lay-out of the installation is shown on the accompanying plan, fig. 1.

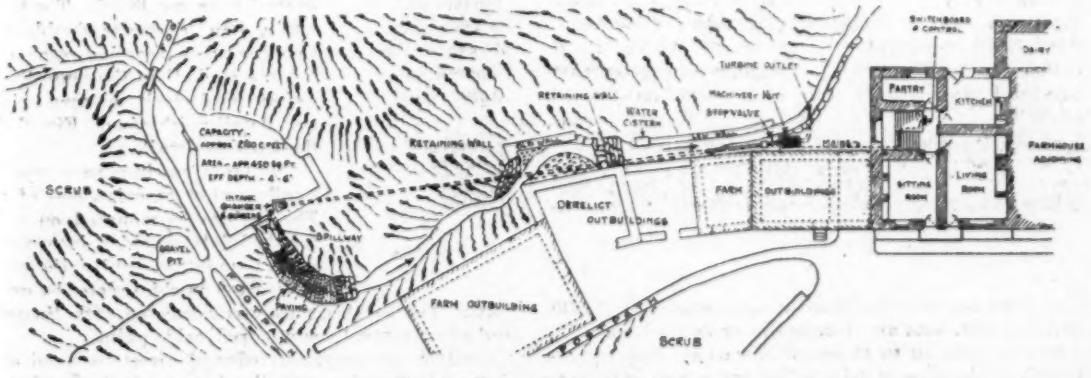


Fig. 1.—Plan of Installation.

The plant represents the results of the author's spare-time efforts during 1916-1920, and was put into running commission in December, 1917, detail improvements being added during the ensuing three years.

As originally planned, the scheme was to install a

home-made set of 150 watts capacity; an intake bay to be built direct in the stream bank, and the plant to work under an effective head of 24 ft. 6 in. However, when the intake bay was complete and a fair portion of the pipe line laid, an opportunity of obtaining a second-hand ½-h.p., series-wound, 1,200-r.p.m., d.c. motor presented itself. The field system of the motor was accordingly rewound as cumulative compound, a suitable turbine built, switchgear and temporary wiring fitted, and the plant put into operation.

It soon became apparent, however, that the larger plant was beyond the capacity of the stream during long fine spells and frosts, without recourse to impounding, and a scheme to provide this was accordingly commenced during the summer of 1918 by means of excavation and the raising of the spillway level to give an effective head of 27 ft.

The resulting dam and reservoir are illustrated in figs. 2 and 3. The original intake bay was modified and incorporated in the new dam and fitted with very much larger screens, as the originals gave much trouble owing to the accumulation of trash.

Figs. 2 & 3.—The Reservoir and Dam.

Fig. 4.—The Tailrace.

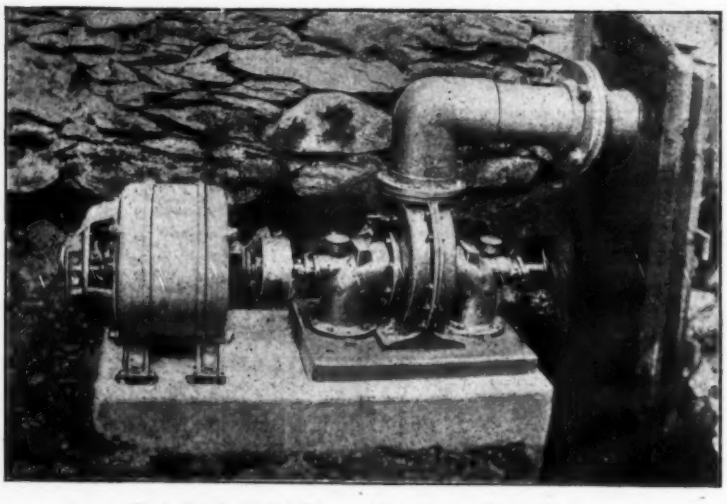


Fig. 5.—The 550-Watt, 85-Volt Turbo-Generator.

The capacity of the dam is approximately 2,100 cu. ft., and will, with an average winter flow, give a full-load run of from 10 to 12 hours' duration, whilst with average summer flow it will suffice for a run of about two hours.

The dam foundation is of concrete, 2 ft. thick (laid direct on rock), upon which is built a wall laid with Portland cement on its inner side and lime mortar on the outside. A dry-laid retaining wall was built along the western, or path, side of the reservoir, and a short wall similar to the dam itself along the eastern side, running up to surface rock. When this masonry (for which professional assistance was obtained) was complete, excavation further back was continued and the spoil thrown in front of the wall to form a bank. As the level of this bank rose, clay was puddled in between it and the dam wall. All the walls were ultimately cement pointed, and the reservoir is quite watertight up to within about 9 in. of the spillway level, after which seepage occurs through faulty rock on the eastern side.

Inside the intake bay, and fitted directly on the end of the pipe line, is a cage composed of pitchpine and galvanised wire gauze. The pipe line is 120 ft. in length, and consists of 6-in. diameter stoneware piping. It is laid with an average cover of 3 ft. of soil until within 60 ft. of the turbine, where it rejoins the stream course and is covered by about 1 ft. of gravel. The gradient flattens out gradually to horizontal at the turbine stop valve, between which and the turbine it is reduced to 4 in. diameter. All joints were located with a packing of rope and then cemented. A concrete anchorage block was moulded round one of the joints adjacent to the stop valve.

Fig. 4 shows the turbine tailrace and spillway stream, the plant being in operation at an output of 250 watts when photographed. The outlet pipe clearly shows the amount of water required for this output.

Fig. 1 shows the route of the stream and pipe line, the latter passing along the stream course and up to the dam in practically a straight line.

Fig. 5 shows the turbine and generator before the housing and control gear was fitted. The turbine has a 4-in. diameter double-ended, combined-flow, reaction rotor, and is "home made" in the sense that the writer undertook pattern making and detail machining. Fig. 6 shows the turbine details.

The main castings were machined locally owing to exigencies of time. The turbine is mounted on a 3-in. oak bedplate moulded into the concrete foundation, whilst the generator is fixed on shim plates by grouted bolts. The oak bedplate was saturated with linseed oil and given several coats of red oxide paint.

Control was originally effected direct by hand on the sluice ring pinion spindle, but a wheel sprocket and chain, coupled to flexible galvanised steel wires laid in underground conduits to the house was fitted later. A small winch, with a similar sprocket and chain, fitted on the main switchboard, forms the driving element.

The generator proved itself to be capable of a continuous output of 550 watts; the voltage is 85 and the

speed 1,250 r.p.m. The combined efficiencies of the plant at various loads, as obtained by rough-and-ready means, are as follows:—

Full load	...	...	...	36 per cent.
¾ load	...	...	...	32 per cent.
½ load	...	...	...	27 per cent.
¼ load	...	...	...	18 per cent.

The very low efficiency at low outputs reveals the great failing of the reaction type of turbine when employed on a system where every drop of water counts. The impulse type was ruled out, however, owing to the large gear ratio, or multiple-jet type wheel, that would have been necessary in view of the small available head. The discharge from the turbine is effected through a draught tube consisting of stoneware piping terminating in a water seal and outlet bend.

No. 16 s.w.g. lead-covered v.i.r. cables drawn through underground galvanised screwed conduit form the link between the generator and the main switchboard in the dwelling-house, a run of 33 ft.

The main switchboard is built of oak, in box form, hinged upon its base to provide access to the interior, and carries two single-pole fuses, one d.p. switch, one ammeter, a voltmeter with a fuse and tumbler switch, and the control handwheel. Mains are carried through a partition to a four-way, 5-amp. per way distribution box almost immediately behind the main switchboard. There are eleven lighting points and six plug sockets divided into three circuits, the remaining circuit supplying four power sockets.

The hand control is usually set to supply three 30-watt lamps. If, under these conditions, an extra light is switched on, the voltage drops 6 per cent., but with metal-filament lamps this is not too noticeable and, of course, if the extra light is likely to be required for any length of time, it is a simple matter to operate the hand control. It was thought that a governor could be dispensed with, and the experience of six seasons' running bears this out; fuses have certainly blown once or twice, and the voltage has consequently risen above the scale of the voltmeter (120 volts), with dire results to carbon-filament lamps, but none apparently as far as metal-filament lamps are concerned. Two only of the latter have failed so far—one due to faulty vacuum and the other to badly-annealed glassware.

Of the three lamps usually in service, one, an 80-volt 8-c.p., carbon-filament lamp, is always in circuit. This lamp has a two-pin socket in parallel with it, and when the household retires for the night a small water heater is plugged in and has the effect, in addition to dropping the voltage to 55 (at which point quite efficient night lighting is obtained), of raising the output of the plant from 90 to 120 watts, the slight reduction of speed of the generator resulting in reduced friction, windage, excitation, &c., losses. The heater ensures that the plant is running fairly efficiently during the night and results in the provision of about 2½ pints of simmering water to brew the matutinal cup of tea or coffee.

A 500-watt domestic iron, a vacuum cleaner, a 3-pint kettle, and two 500-watt radiators (the latter being quite sufficient to take the chill off a room of the usual country cottage dimensions) are used from time to time—of course, singly—but the water heater is the usual load, and it is kept in use all day when water conditions allow, as they usually do in winter, and provides three further "boilings" of water for domestic purposes.

A further use for the plant has been the charging of 4- and 6-volt accumulators in series with the load. A two-way switch is inserted in one of the mains from the main switchboard to the distribution box. No automatic cut-in and cut-out is fitted, or is necessary, since, in the event of the water supply failing, as in times of shortage it has done—in the "wee sma'" hours—the resistance of the circuit is sufficient to limit the discharge rate to half-an-ampere in the case of a 6-volt cell; also, this low voltage is insufficient to cause risk to the residual magnetism of the generator.

This cell charging is occasionally carried out in series with one of the radiators on "low" heat, the radiator being placed in one of the numerous cupboards for "airing" purposes—a great boon. The rating of the radiator on this system is 200 watts, which is ample for the purpose.

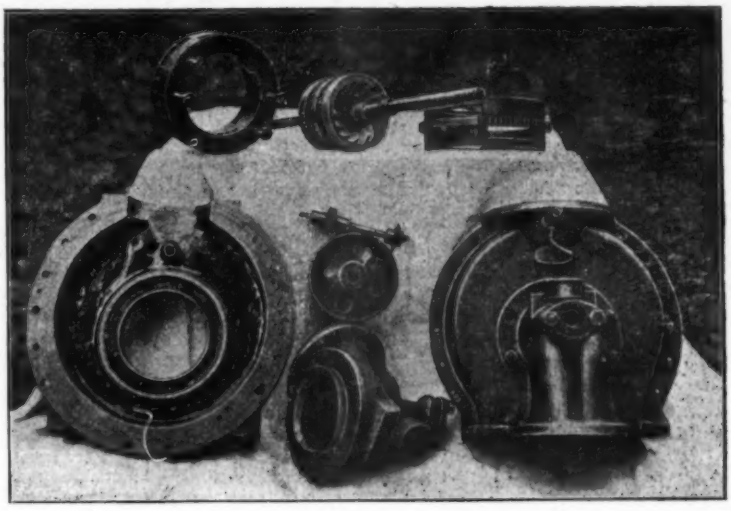


Fig. 6.—Component Parts of Turbine.

In conclusion, it can truthfully be said that the plant is perfectly reliable, the only involuntary stoppages, other than those due to failure of the water supply during the night, being in the early days of its installation; they were caused by the accumulation of air in the inner water inlet cage, a trouble which was overcome by fitting a pipe outlet to atmosphere. The plant has many times run constantly for from three to four weeks, and occasionally six weeks without even being inspected. Usually, the grease cups on the turbine bearings are given a turn about once a month, and the generator commutator is cleaned up at the same time.

The writer earnestly advises all those who contemplate the installation of similar miniature hydro-electric plant to endeavour to obtain a sufficient head to justify fitting an impulse wheel, both on the score of higher efficiency at varying loads and ease of control. As before stated, the plant under review is sadly inefficient just where high efficiency is most needed. Further, the extra cost of the pipe line, due to the greater length, will most probably be more than counterbalanced by the smaller bore of pipe and the fact that it will possibly be feasible to operate without recourse to impounding. Such would have been the case with the plant described above had the writer had sufficient foresight and planned the installation on its present scale in the first place.

Model Engineering Exhibition.—The seventh annual exhibition organised by the *Model Engineer* will be held at the Royal Horticultural Hall, S.W.1, from January 4th to 11th. In addition to a number of trade exhibits, there will be the usual interesting collection of work by members of the Society of Model and Experimental Engineers and kindred associations. The show will be open from noon to 10 p.m. each day, the price of admission being 1s. 6d. The organisers' address is 66, Farringdon Street, E.C.4.

ADVERTISING IN THE ELECTRICAL INDUSTRY.

The E.D.A. Salesmanship Conference on December 14th was held at the London School of Economics, Houghton Street, Kingsway, London, and it is hoped that this arrangement will be permanent. A paper was read on this occasion by Mr. W. E Warrilow, in which he dealt with advertising in the industry as it concerned the manufacturer and the retailer. Mr. H. Marryat (Messrs. Marryat & Place) presided.

Mr. Warrilow said that, although it would be presumptuous to suggest that advertising could take the place of all other methods of selling, evidence was available to prove that it was one of the most powerful factors in business building. While he had always believed that the electrical advertising man should possess electrical knowledge, there was no denying that the expert in matters purely of advertising copy, lay-out, and design, had an enormous scope in the electrical industry for the display of his talents. It was gratifying to record a marked advance in the manner and matter of electrical trade advertising, particularly during the last seven years. But there was need for greater courage and confidence than ever on the part of all branches of the industry.

With regard to the advertising of heavy plant and machinery, Mr. Warrilow said that there was a healthy tendency for many firms to spend money on good photographs of the plant in process of manufacture and after its installation. With regard to domestic apparatus, there were two kinds of advertising, the first being by the manufacturer, advertising through the trade Press to the factor and retailer. The industry was plentifully served by trade journals, each of which contained excellent advertising matter, and for a moderate outlay the retailing section of the industry could be reached. The second kind was advertising by the manufacturer through the newspaper Press *at* the buying public for the benefit of the retailer, and in this connection he emphasised the importance of branding an article with an attractive name. The copy was designed to interest and instruct the general public, but this field was at present almost undeveloped from an electrical point of view, and great prospects awaited progressive advertisers in this direction. While the services of artists to assist in the production of popular announcements were expensive, they usually justified the outlay. When the advertising man had a standardised named product to deal with he could prepare in advance copy for a complete campaign covering a period. The retailer should be in readiness with his showcards, leaflets and stocks of the articles named, received from the manufacturer. These campaigns could be conducted locally as well as nationally. What was being done with named articles, such as lamps, could also be done with irons, fans, cookers, fires and other domestic appliances, and an enormous undeveloped field awaited the advertising man in this direction. He could put forward no more powerful argument for a determined attempt at the standardisation of these products than that they were most effectively advertised in that form. A form of direct co-operation between manufacturer and retailer was where the retailer placed a definite order with a manufacturer for an agreed minimum number of pieces, in return for which his name and address were given a prominent place in the manufacturer's advertisements, with those of other retailers, in a national newspaper. This kind of advertising was very successful.

A new phase which was being entered upon, where the retailer bought or loaned blocks and matter from the manufacturer, and advertised locally, was a real step in the right direction. Groups of retailers should contribute to a common local advertising fund and thereby permit of larger spaces being taken in newspapers; also, with such a fund, poster work could be attempted with the co-operation of the E.D.A. Much apathy was still displayed by supply authorities. The central station man's advertising could be most effective in his own area if arranged to assist local retailers.

In conclusion, Mr. Warrilow emphasised the value of the E.D.A. to the industry as a co-ordinating force.

In the discussion which followed,

Mr. W. R. Rawlings said that the manufacturer reaped the benefit, and therefore he was the man to do the advertising. More co-ordination in the electrical Press was wanted, and if there was one good journal it would be better for the advertiser, the reader, and the publisher. He appealed for a special tariff for contractors for demonstration purposes.

Mr. W. E. Rogers (West Ham) said that supply companies did not believe in advertising as a paying proposition.

Mr. R. W. Hughman emphasised the importance of local advertising, and, as an instance, he referred to a month's campaign carried out by the Hartford (Connecticut) Electric Light Co. They had 36,000 residences on their mains, and concentrated on a particular 150-W lamp for lighting kitchens. It was fitted free for a month's trial, and if it was not kept by the householder after that it was taken away, no charge being made; but if it was kept it was paid for in three monthly instalments. The contractors were invited to co-operate in the publicity programme, their names appearing in advertisements. The result was that 7,000 fittings were sold, the contractors got into 7,000 homes, and were then able to talk about other fittings.

Mr. G. Campbell (Benjamin Electric, Ltd.) deprecated the practice of some advertisers of cramming space with too many words; people would not read them. Trade papers should be read by the trade, because they all contained information which was of great use. The E.D.A. should consider, in conjunction with the electrical Press, the question of getting the technical journals read by those in the industry first. In 1924 he believed there would be an increased volume of trade, but there would have to be lower prices for goods and more advertising.

Mr. A. C. Morton said that manufacturers of lamps had a distinct advantage over manufacturers of fires, kettles, irons, &c., because the latter only needed renewing very occasionally, and that had an important bearing on the consistency of advertising. Emphasing the importance of co-operation, he pointed out that recently an electricity undertaking in the suburbs of London had had 310 kW of fires connected in the area, but could not take any more, though it had 500 applications. It was a very serious matter to ask manufacturers to advertise when customers were unable to use the apparatus. As to the technical Press, the latest figures he had for the electrical paper in America which had the largest circulation showed that it had about 32,000 readers. The Electrical Review had over 13,000. America, however, had 10,000,000 wired homes, whilst this country had only 1,000,000, so that if we were on the same basis as the Americans, the circulation of the Electrical Review would be about 130,000.* Therefore we were well ahead of America, *pro rata*.

Mr. Alderson Smith, commenting on the apathy of central-station engineers, said that only about 100 out of 600 were really taking publicity seriously. Also he did not suppose 50 contractors out of 1,000 were doing their share. Until station engineers realised that the propaganda work of the E.D.A. and others was really a part of their selling organisation, he was afraid that business would be retarded. Electrical trade journals in this country were doing their part; they were very well received, and widely read, but big undertakings took only a small number of copies, which had to be circulated among a large number of men, with the result that the information contained in them was weeks old when it reached some of the men. That state of affairs should be remedied.

Mr. L. L. Robinson (Hackney) said he wanted to know the result of the installation of the 150-watt lamps at Hartford when the quarterly meter reading came round. It was a mistake to oversell to a consumer, and it was the duty of all to give the consumer service at the lowest price.

Mr. Hughman said there was a two-part tariff, and the price of the current used in these lamps was 2¼d. per kWh.

Mr. L. L. Robinson still considered the installation of 150-watt lamps unnecessary. In his opinion no advertising paid as well as local advertising by supply authorities.

Mr. H. T. Young (Messrs. Troughton & Young) maintained that retailers would be happy with less immediate profit if manufacturers went all out on a national advertising campaign, because they would be better off in the long run.

Mr. H. King (Ilford) said that as the result of a recent electrical exhibition, in which local contractors co-operated, the supply authority at Ilford had been inundated with applications for a supply.

The Chairman asked for advice from Mr. Warrilow as to how a local firm should proceed with advertising.

Mr. Warrilow, in reply, said that many attempts had been made to produce popular electrical papers, but most had failed. The tendency was for manufacturers to go in for the magazine and illustrated Press, and he considered that that was the right direction. It must be hammered into the retailer that he must stock the advertised article. Unlike Mr. Robinson, he believed that the contractor, properly led and organised, could become a powerful factor in selling electricity consuming devices.

Gas Turbines.—Mr. Jules Deschamps, writing in the *Engineer* and referring to that journal's recent series of articles on the above subject, concludes that the entire theory of gas turbines needs to be revised. That will only be possible when a great number of experimental results are available with which to check the formulæ which it is proposed to use in future. The greater part of those now employed, notably those for the mixtures of gaseous fluids, he says, lead to erroneous conclusions and must be modified. It is only systematic research, without preference for this or that method, at least at the beginning, which can indicate the directions in which to proceed, and he is convinced that those who have the actual means of carrying out such studies would advance in front of those who wish to-day to construct a turbine on existing data, and that this advantage would be of considerable magnitude.

* This matter is referred to in our leaderettes.—Eds.

THE EVAPORATION UNIT.

Messrs. Ed. Bennis & Co., Ltd., have sent us the following useful article and table, compiled by their Mr. G. A. Rossetti. They will be pleased to forward copies of the table to any reader on application to their Westminster address:—

"After the fundamental unit, the British thermal unit (B.th.u.), the most important unit of heat measurement in use among engineers is the evaporation unit (ev.u.). The B.th.u. means the amount of heat needed to raise 1 lb. of water 1 deg. F. at the mean specific heat of water between 32 deg. F. and 212 deg. F.; the ev.u. means the amount of heat needed to convert 1 lb. of water at 212 deg. F. into saturated steam at the same temperature and consequently at the atmospheric pressure of 14.7 lb. per sq. in.

"In the case of boilers generating steam for power production and for various industrial uses, the conditions of this steam generation vary widely, and, in order readily to compare results from different sources, it is customary to reduce the boiler output to evaporation units (sometimes termed "lb. evaporated as from and at 212 deg. F."). For this reduction it it necessary to know the equivalent of the evaporation unit in British thermal units. This equivalent is given in the steam tables, the best known of which are those of Profs. Callendar, Marks and Davis, and Peabody. Of these, Prof. Callendar's table is probably the most reliable, being founded on the soundest basis yet possible, both theoretical and experimental. The table of Profs. Marks and Davis is recognised as standard in the United States, and is frequently specified as the basis for test calculations by British engineers. Prof. Peabody's table, though perhaps somewhat superseded by the two later tables, was undoubtedly the best authority on the subject twelve years ago, when its eighth edition was published. Naturally, the principal differences between these tables occur in regard to the properties of steam at the higher temperatures and pressures, where experimental difficulties are most serious. But there is not absolute agreement as to the fundamental constant, the number of British thermal units equivalent to one evaporation unit. The writer, having found the short table given below convenient in his own use, thinks that it may be acceptable to engineers generally who have to deal with these conversions. The table gives the equivalent of the ev.u. in B.th.u. according to each of the three authorities above mentioned, and also gives the conversion factor for each of the values of the ev.u. in terms of each of the others, and for the number of ev.u. equivalent to 1,000 B.th.u. The logarithm of each of the conversion factors is also given, thus providing the maximum assistance for these calculations. The several values of the evaporation unit are referred to by the initials (C.), (M. & D.), (P.).

CONVERSION FACTORS AND LOGARITHMS.

	Factor.		Logarithm.
1 Ev.u. (C.)	= 970.74	B.th.u.	2.98710293
	= 1.00035037	Ev.u. (M. & D.)	0.00015214
	= 1.00107250	Ev.u. (P.)	0.00046553
1 Ev.u. (M. & D.)	= 970.4	B.th.u.	2.98695079
	= 0.99964976	Ev.u. (C.)	0.99984786-1
	= 1.00072187	Ev.u. (P.)	0.00031339
1 Ev.u. (P.)	= 969.7	B.th.u.	2.98663740
	= 0.99892865	Ev.u. (C.)	0.99953447-1
	= 0.99927865	Ev.u. (M. & D.)	0.99968661-1
1,000 B.th.u.	= 1.03014195	Ev.u. (C.)	0.01289707
	= 1.03050288	Ev.u. (M. & D.)	0.01304921
	= 1.03124679	Ev.u. (P.)	0.01336260

"The factors and logarithms are given to eight decimals, but usually not more than five or six of these will be needed."

Damping and Speed in Radio Reception.—The paper that was recently read by Mr. L. B. Turner, M.A., M.I.E.E., before the Wireless Section of the Institution of Electrical Engineers on the relations between damping and speed in radio reception is divided into two sections. Part I is devoted to an examination of the ordinary method of recorder working in radio telegraph receivers, as affected by the damping of the receiver circuits. After a résumé of the significances of the decrement of any oscillatory system, its bearing on the possible speed of recording Morse signals is investigated. The quality (approach to correct Morse "shaping") is estimated from calculated curves of amplitude of oscillation set up in the receiver by the incoming dots and dashes constituting the letter "l." By comparing several such curves a minimum practical value is found for the product of frequency and decrement and duration of Morse dot. The relation between speed of signalling and the requisite transmitter power is then investigated. In Part II an improved method of reception, called "receiver curbing," is described and analysed. An estimate is made of the improvement obtainable, and circuits are given for putting the method into effect.

LEGAL.

Quitmann v. Anglo-American Metal Co.

IN the Mayor's and City of London Court on December 18th, before the Common Serjeant (Sir H. F. Dickens, K.C.), and a jury, a claim was made by C. Quitmann, exporter and importer of lighting glassware, 3, Cloth Street, London, against the Anglo-American Metal Co., Aldersgate Street, E.C., for £118 for glass electric light globes supplied and charges paid on its behalf. Defendants counterclaimed for £47 loss of profit. Mr. Blanco White and Mr. Mullins were counsel for the plaintiff and Mr. Werninck represented the defendants. Plaintiff's case was that he received an order from the defendant for clear-glass dishes and well globes with star-cut bottoms. Defendant's order specified that the globes and dishes should be "exact to drawing." Plaintiff had since ascertained that the defendant had a contract to supply the globes and dishes in question to the London General Omnibus Co., which had rejected the goods. The defendant had refused the goods on the ground that they were not according to drawing. The plaintiff's case was that in the glass trade there was a customary variation in measurements by which 1-32 in. or 1-16 in. in the flange of the globe or dish was allowed. The goods he had supplied were within that allowable variation of measurement and were, therefore, in accordance with the order. Defendant's contract with the L.G.O.C. stated that the goods were to meet the company's approval, but such a condition was not made between the defendant and plaintiff. The defence was that the globes in question were not in accordance with the drawings. If there were to be any variations in measurements the flanges of the globes should have been thicker and not thinner than those supplied. The jury found a verdict for the plaintiff for the full amount of the claim and judgment was entered accordingly, with costs.

CORRESPONDENCE.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Petrol-Electric (Battery) Propulsion.

The letter from Mr. H. Green headed "Petrol-Electric (Battery) Propulsion" in your recent issue is very gratifying to me as affording further proof, if it were necessary, of the wastefulness in fuel of the ordinary petrol-driven car in comparison with one on which the engine is working under reasonable conditions of efficient loading. I am glad to note that a Britisher has had the courage to put up a machine of this kind, although, as mentioned at the reading of my paper, I am aware of the existence of several machines of the type to which he refers. These vehicles may be classed as battery electric vehicles carrying their own generating plant, and to cite three other cases at random, I would mention the Woods, the Day, and the C.M.B. (Crompton).

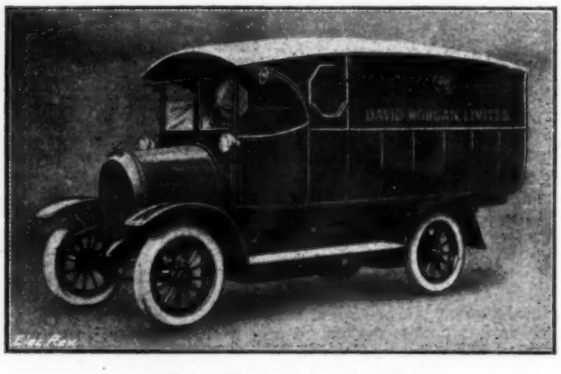
It is my opinion that the future of the battery electric, at any rate in England, will depend upon its self-charging abilities, as the central stations of the country, particularly those owned by private companies, have thoroughly "let down" electric vehicle enterprise by their arrogant disregard of the possibilities of valuable revenue from this kind of load. It is true that there are a number of central stations which have really gone to some trouble to get this business, but, without co-ordinated effort among the central-station engineers of the whole country, the user of an electric vehicle is very limited in the service he can obtain and, in consequence, it is only in very specialised applications that the great advantages of pure battery electric traction can be obtained.

I would be of further great interest if Mr. Green would give a detailed description of his machine and, in particular, if he would state his petrol consumption in ton-miles per gallon. Even supposing his figure of 20 miles per gallon relates to his vehicle in an unloaded condition, he must be obtaining 120 gross ton-miles per gallon, which is approximately the same figure as the record for this class of lorry at the present time. The makers who set up this particular record have advertised it extensively, but inquiries with regard to the kind of performance they would guarantee for the same class of engine and gear box in commercial service on good roads in the open country promptly brought them down to the more usual figure of about 60 gross ton-miles per gallon, and this only when the lorry was fully loaded.

The chief objections to the scheme which Mr. Green discusses are the rather considerable plant cost (he requires both a dynamo and a motor, and in his case the motor has apparently been split into two units, making three electrical machines in all), and also the fact that the transmission efficiency in terms of engine power delivered to the road wheels cannot possibly exceed the maximum combined efficiency of the dynamo and motor(s). Even with the utmost

care in design it is not likely that this figure will exceed 65 or 70 per cent., as compared with a probable 85 or 90 per cent. with an orthodox gear-box drive, so that the petrol economy obtained is even more surprising.

It may also be of interest to state that there is one vehicle obtainable at the present time, which is marketed either as a pure electric, or can be supplied with its generating set housed in a bonnet, in the same way as with regular petrol cars. I



The "Elite" One-ton Van.

enclose an illustration of this machine in the form of a van for carrying 1-ton loads. The petrol consumption obtainable is from 30 to 35 miles per gallon, depending on the amount of load carried.

I can quite appreciate your correspondent's strictures on British Patent Law, but I cannot think that he has very much to complain of with regard to schemes of the type described, as the addition of a charging set to a battery vehicle in the way described is not in any way novel, and could only be patented in any special details which might form a novelty in connection with the generally well-known principle.

The scheme discussed in detail in my paper differs from Mr. Green's application and from previous examples of the same kind in that it is only necessary to employ one electrical machine, and that a large proportion of the raw mechanical power from the engine is transmitted direct to the road wheels without loss of efficiency. It thus has a higher efficiency, and therefore lower petrol consumption, than the battery-electric plus charging set, and, at the same time, retains the ability to load the engine economically as regards its throttle setting; moreover, the general simplification by cutting out the additional electrical machine is considerable, so that both in first cost and in weight my "Dual-Power" machine compares favourably with orthodox petrol vehicles.

I have made a very careful investigation of all the previous proposals that I could find in various countries, relating to both electric and combined vehicles, and, although many previous investigators have realised the importance of working an engine all the time at its economical setting, I have been unable to discover any application of the particular system of electrical control which I employ. This gives a much more facile choice of speeds than the existing series motor layouts, and enables the petrol engine torque to be added, if required, without in any way disturbing either the efficiency of the arrangement or the ease of control.

Arrangements are in hand for the manufacture of this type of vehicle, and there is little doubt that, when road vehicles are available which can be used in place of the present battery electrics as well as improve on the efficiency of the present petrol types, central-station engineers will commence to look for the battery vehicle load which they might have had if they had not been asleep to the possibilities in this direction for the past ten years.

L. Murphy.

Westminster, *December 18th*, 1923.

Delayed Deliveries.

Your correspondent "Disgusted," in last week's Review, we think puts the matter very clearly, and we are in entire agreement with what he writes.

The writer, who has been in the electrical trade for many years and handles a great variety of all classes of material, never experienced such an enormous waste of time as now occurs in trying to get on with ordinary everyday business.

There is no doubt that it is to a great extent due to the aftermath of the war, which now finds the wrong people, of no experience, commercial or technical, in positions in which they have no right to be; but still they are there, and while they are there, one has to treat with them.

Your correspondent "Victor" also writes a great amount of fact, touching upon the incompetence of men who have the management of concerns, but who are not in personal touch with their clients, and think themselves tin gods.

From our own experience, when endeavouring to get into personal touch with them, they will not move off their office chairs to speak on the telephone, but will send the office boy backwards and forwards rather than give themselves a little trouble.

We see no immediate remedy at present until heads of concerns take a personal interest, and insist upon their employés doing the same, in the conduct of their business.

Davis Electrical Co., Ltd.,
John Davis, *Director.*

London, *December 17th*, 1923.

Your leading article and letters on the delivery question are interesting; the latter would be more so, if they were not all written under *noms-de-plume*.

Why is it that the larger percentage of goods are delivered after the due date? There are many reasons, among which will often be found the following:—

(1) An impossible delivery date given in the first place.
(2) Delay in starting on orders.
(3) Late ordering of limiting material.
(4) Delays caused through outside supplies.
(5) Errors in manufacture.

(1) If a firm deliberately gives an impossible delivery date it deserves all the trouble it gets; it is occasionally done to secure an order, but it does not get the next.

(2) It is deplorable, the delay that often takes place before many contracts are started on. Take a piece of machinery promised in four months from receipt of order: Two months will often elapse before complete instructions are issued to the works. When the due date arrives assemblers, testers, &c., are working overtime for weeks to patch up other people's delay; the pressure is applied at the wrong end. If proper attention is given to the order during the first few weeks, many hours of overtime and night work can be avoided.

(3) Here again, the administrative staff is to blame. It is useless for one to try to console himself by thinking: "We have another three months on the job yet, there is plenty of time for that steel casting." If the steel casting could have been ordered three weeks earlier, and delay in its arrival occurs, then the person responsible for ordering it is to blame and not the foundry.

(4) We are all occasionally let down by outside supplies; then make provision to cover others' failings as far as possible—order in advance and inquire for delivery before the material is due.

(5) These will always occur in the best-regulated shops, but they can be reduced to a minimum by good supervision.

The above remarks apply chiefly to goods made to order. I am convinced that English engineering firms are ready to make "anything to order" rather than "limited lines for stock." An argument against the latter is that sales would be limited; it is not so. When any one firm is supplying more than 50 per cent. of the total demand of a given line, then it can talk about limited sales, saturation of the markets, &c. A firm specialising in a certain product often effects more constant sales and can safely carry stocks, and consequently give better deliveries than its competitors. It is in a much better position to keep its delivery promises, because if the article is not finished in stock, the components may be, and an accurate judgment can be made of the time required for completion.

A promise given for delivery is as much a promise as one given for quantity: While many firms will honour the latter, many will ignore the former. Why? They are both promises.

Walter F. Higgs.

Birmingham, *December 17th*, 1923.

I have read with interest your article on the above subject in the current issue, and also the correspondence.

It may possibly interest your readers to hear the views of the manager of a manufacturing concern which, strangely enough, has never found any difficulty in keeping to promised deliveries.

Obviously, the important thing is not to promise deliveries that you have not a reasonable chance of keeping; secondly, if you find that you are likely to be late, write to the customer and tell him so.

The letters of "Ex Adverso" and "Very Sorry" merely give a list of the ordinary manufacturing difficulties which occur in every electrical business.

The only valid excuse for delay is that of an accident which could not have been reasonably foreseen.

I do not think that a cumbersome system, as you suggest in your article, is the cause of exceeding the delivery promised, but it is undoubtedly the cause of slow delivery.

Red tape is quite inseparable even theoretically from large concerns. You cannot allow discretion to one member of the staff without giving it to all, with, of course, resulting chaos.

In every concern, large or small, there is a quite distinct character, wqich may take the form either of punctuality,

slackness, efficiency, or inefficiency, and depends to a large extent on the personality of the chief executive officer.

If he has the instinct of punctuality his goods will be delivered up to time; if he is unpunctual in his own habits then unpunctuality will permeate the whole concern. Twenty-five years' experience has shown me that you cannot inculcate the virtues in your staff which you do not yourself possess.

A great deal, however, may be done by a system properly applied, and the first thing is to reduce the amount of clerical work to the least possible; to get your order into the shop, and order such material as may be necessary, at the earliest possible moment. This is where the small firm scores.

As a rule delays do not occur in the actual shop, because except in very badly managed concerns it is largely to the foreman's interest to get the work through, and where there is payment by results, very much to the man's interest.

It is the on-cost man who is to blame, because his job largely consists in filling up forms which represent little or nothing to his mind's eye.

I cannot, however, too strongly insist on the vital importance of publicity throughout the works. There is far too much secrecy as to customer's names, and it even goes to the length in some places of not allowing, say, a 5/16 x 1 in. cheese-head screw to be known as such, but it must be known instead by some elaborate number. This system may curtail an additional digit, but it introduces instead a complicated process of thought, and the looking-up of lists.

One thing to my mind is vital, and that is: If you see you are going to be late, put yourself right with your customer by telling him so, and when your next promise is given be certain that it is a promise you will anticipate.

If you tell a customer that he will get his goods in three weeks, knowing that you will probably be able to dispatch them in two, and you do so, he is so pleased that you have anticipated, that he will probably forgive you your original delay.

What causes the letters from disgruntled customers is endless promises which are never kept.

I must apologise for the length of this letter, but the subject really requires a volume in itself.

"A Stitch in Time."

December 17th, 1923.

Miners' Electric Safety Lamps.

In your issue of the 14th inst., under the heading "Miners' Nystagmus," you give details of the Ebbw Vale Co.'s experiment with canary yellow well glasses in miners' electric safety lamps, but for the benefit of your readers, perhaps you will allow me to give a brief description of the developments which have taken place since the Ebbw Vale Co. started its experiments.

It has been known for many years that the elimination of certain rays of light by the substitution of tinted for clear glass would benefit those unfortunate persons who had become afflicted with that peculiar eye disease—nystagmus. Unfortunately, however, the substitution of tinted glass means a reduction—certainly only a slight one—in light, and as the candle-power of a miner's electric lamp is only one, any loss of light, however slight, is felt very badly. It was, therefore, considered that any experimental work should be in the direction of increasing the light rather than decreasing it.

In conjunction with a well-known lighting expert, I have for some time past been carrying out experiments with what is termed a dioptric well glass, and a few months ago I was able to submit samples of this glass to Dr. Wheeler, the chief testing officer of the Mines Department, who carried out tests with this glass at the Mines Department testing station at Eskmeals, in Cumberland. These tests showed that the frosted dioptric glass, whilst giving a beautifully diffused white light, increased the horizontal candle power by from 50 per cent. to 70 per cent. This result was so satisfactory that I felt quite justified in proceeding to manufacture for general use, and the dioptric glass was first shown to the public at the Mining Engineering Exhibition recently held in Cardiff. Enormous interest has been created amongst the local colliery owners, and the majority of the largest colliery concerns are at once proceeding to put a certain number of these glasses into use.

I feel confident that the introduction of the dioptric glasses will not only prevent, and cure, nystagmus, but will be of great benefit to the more fortunate collier who is not thus afflicted, by giving him increased light at his work.

Theodore Stretton,
Managing Director
Thor Electric Safety Lamp Co., Ltd.

Recent Tendering for Electrical Contracts.

In reply to Mr. E. A. R. Paton, M.A., and "Constant Reader," I fully endorse their remarks concerning the large manufacturers of plant, but if they were to examine some of the smaller lighting and power installations in course of erection, I think the vast difference in price would be apparent. Below I have appended a few of the differences in workmanship and material as used in extreme cases:—

	Cheap.	Good.
Conduit	Not reamered	Reamered
—	Not properly fixed	Well fixed
—	Unsightly runs	Neat
Cable	Cheap competition	C.M.A.
—	Crowded in conduit	Plenty of room
—	Braiding not bared back	Correctly bared
—	Jointed in conduit	No joints
—	Smallest permissible size (sometimes smaller)	Ample capacity
—	Left exposed in false roofs and under floors	Tubed up
Conduit fittings	Inferior in quality and quantity	Best quality Quantity required
	If close joint, slip fittings	Grip fittings
Switch blocks, &c.	Fixed with 1 screw	Fixed with two or more screws
Switches, C. roses holders, &c.	"Cheap and nasty"	Good
	Slipshod workmanship	Excellent workmanship

A good job costs more in the first instance. A cheap job costs more in repairs. Trusting this will enlighten Mr. Paton and "Constant Reader," and perhaps be of use to the E.D.A.

Roland A. Hill.

Hull, *December 17th*, 1923.

Several letters have been received too late for insertion in this issue.

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. XCIII (for the half-year ending December 31st, 1923) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—Raymond Billington, 163, Walker Street, Kingston-upon-Hull, electrical contractor.—The receiving order in this matter was made on November 17th, 1923, on debtor's petition. According to the statement of affairs, there were liabilities of £245, and the assets amounted to £17. The first meeting of creditors was held on December 11th, 1923, at the Official Receiver's office, 36, Scale Lane, Hull. The following are creditors:—

	£		£
General Electric Co., Ltd. ...	34	Yorkshire Electric Supplies Co.	37
Telephone Manufacturing Co. ...	23	T. Rashby	53

F. Smith, wholesale electrical accessories factor, 6, Imperial Buildings, Dale End, Birmingham.—Receiving order made December 13th on debtor's own petition.

Samuel Lee Bapty & Neville Miles, trading as the Wireless Instrument Manufacturing Co., Avenue Works, Avenue Road, Willesden Junction.—The public examination of these debtors was held at the London Bankruptcy Court on December 19th, before Mr. Registrar Mellor, the accounts showing total liabilities of £1,752 (unsecured £1,152), and net assets valued at £1,091, after allowing £76 for payment of the preferential claims. The debtor Bapty, in reply to the Official Receiver (Mr. Waterer) stated that in June, 1922, he and Miles purchased for £300 an existing electrical engineers' business, carried on by Miles and another person at 132, Northcote Road, Battersea, and with £250 borrowed money, of which £75 was still owing, they commenced business in partnership as wireless instrument makers under the style of "Bapty and Miles." In the following August they removed to Willesden, and thereafter traded as "The Wireless Instrument Manufacturing Co.," until last August, when, in consequence of pressure by creditors, they filed their petition. The partnership was a verbal one. The £250 was borrowed to enable them to pay for the business, but was used instead for working capital, and the vendor, Mr. Pack, was a creditor for the whole amount of £300. The trading was successful for a time and showed a profit. The usual books of account were kept during the whole period of their trading. Witness admitted that a good many people to whom they owed money did not appear in the creditors' ledger, and that no profit and loss accounts,

nor balance sheets, were prepared at any time. The drawings of the partners were not shown in the books, but during the fourteen months of their trading they had only drawn £180 each for their household and personal expenses. They attributed their insolvency to depression in trade, lack of capital and bad debts. It was in January, 1923, when the Model Electrical Supply Co., Ltd., went into liquidation, owing them £800, that they first realised their insolvency. The examination was concluded.

H. P. Galt, electrical engineer, 56, Norbury Road, Thornton Heath. Receiving order made December 19th on debtor's own petition.

A. H. Duffin (A. H. Duffin & Co., electrical engineers and contractors), Provincial Buildings, Conway Road, Colwyn Bay. First dividend, of 5s. in the £, payable January 16th, at Mostyn Chambers, Colwyn Bay.

J. E. Elliott & Co., trading as John Edward Elliott and James M. Elliott, 12, Broad Street, Oxford, electrical engineers.—A sitting of the London Bankruptcy Court was appointed to be held last week, before Mr. Registrar Mellor, for the public examination of these debtors, who have lodged a joint statement of affairs showing liabilities of £2,730, against assets valued at £159. Mr. Armstrong, Official Receiver, reported that owing to the delay in the filing of the statement of affairs he required further time for purposes of investigation, and, by consent of all parties, the sitting was adjourned until next term.

B. N. Halson, electrician, 29, Mayfield Road, Northfleet, Kent.—Receiving order made December 14th on debtor's own petition. First meeting January 3rd, at the Official Receiver's office, 280a, High Street, Rochester; public examination January 14th, at the Court House, Eastgate, Rochester.

S. Sidwell, electrical engineer, 51, Islington Row, Birmingham.—First meeting December 31st, at the Official Receiver's office, 191, Corporation Street, Birmingham. Public examination January 30th at the Court House, Birmingham.

H. J. A. Maullin (Wilton Engineering Co.), electrical engineer, 124, Devonshire Street, Birmingham.—Trustee: Mr. R. C. Easton, Official Receiver, 191, Corporation Street, Birmingham, released December 12th.

R. W. Russell, electrical engineer and contractor, 30, King Street, Bridlington.—Trustee, Mr. D. S. Mackay, Official Receiver, 48, Westborough, Scarborough, released December 11th.

J. M. C. Hampshire, colliery electrician, 91, Doncaster Road, Goldthorpe, Rotherham. Trustee, Mr. L. J. Clegg, Official Receiver, 14, Figtree Lane, Sheffield, released December 11th.

L. Holman, electrician, 11, Camden Road, Bridgwater.—Last day for proofs for dividend, January 1st. Trustee, Mr. F. W. Darby, Official Receiver, 26, Baldwin Street, Bristol.

H. B. West, electrician, 3, Clyde Street, Canterbury.—First and final dividend of 4s. 7½d. in the £ payable December 28th at the Official Receiver's office, 34, Park Place, Cardiff.

Company Liquidations.—Electrical Services, Ltd., Bradford.—The creditors interested herein were called together recently at the offices of Messrs. Ratcliffe & Co., solicitors, 12, Piccadilly, Bradford, when Mr. Hodgkinson, C.A., of 48, Sunbridge Road, Bradford, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs which showed ranking liabilities of £3,200. The claims of the trade creditors totalled £2,311, and there was a bill payable amounting to £839. The assets consisted of: Cash in hand, £2 8s. 7d.; stock, £587, estimated to realise £300; fixtures, fittings, and loose tools, £139, expected to produce £40; and book debts, £928, valued at £775, making total assets of £1,117, from which had to be deducted £107 for preferential claims, leaving net assets of £1,010, or a deficiency as regarded the unsecured creditors of £2,190. The deficiency account showed that on December 31st, 1922, there was a debit balance on the profit and loss account of £803. The deficiency of £2,189 was accounted for by that debit balance, together with the following items:—Loss on trading during 1923, £415; goodwill written off, £100; preliminary expenses, £18; loss on motor-car, £123; depreciation of stock, £287; depreciation of fixtures, £99; book debts written off, £153; and other items, £191. It was reported that the company was registered in the early part of 1914 with a nominal capital of £1,000. The company took over an existing business, and during 1914 the turnover was £1,150, with a loss of £70. In the following year the turnover fell off, and there was a loss on the trading of £100. Detailed accounts were not prepared again until 1918, when it was found that there was a debit to profit and loss account of about £80. The next accounts were prepared in December, 1920, and disclosed a net profit of rather more than £1,000. During the year to December, 1921, the turnover was £7,400, with a gross profit of £1,500 and a net profit of £320. During 1922 the sales fell to £3,670, with a gross profit of only a little more than £400 and a net loss of £1,010. The loss during 1922 was attributed to the fluctuation of prices. The creditors passed a resolution confirming the voluntary liquidation of the company with Mr. Hodgkinson as liquidator, and also appointed an advisory committee of three of the principal creditors.

Anglo-Polish Electrical Development Corporation, Ltd.—Winding up voluntarily. Liquidator, Mr. E. N. Humphreys, Australia House, Strand, W.C. Meeting of creditors at Australia House, January 1st (all creditors will be paid in full).

Mitchell's Electrical & Wireless, Ltd., 188, Rye Lane, Peckham, London, S.E.—The first meetings of creditors and shareholders of this company were held on December 19th, at the Board of Trade Offices, Carey Street, Lincoln's Inn, W.C. The compulsory winding-up order was made on October 16th upon the petition of Messrs. J. Stone & Co., engineers, Deptford. Mr. J. Barwick Thompson, Official Receiver, reported that the company was registered as a private company on July 2nd, 1920, with a nominal capital of £5,000 in shares of £1 each, the object being to acquire and carry on a retail business previously carried on at the same address by F. L. Mitchell & Co., Ltd. The first directors, who were also the promoters, were Mr. F. L. Mitchell, and Mr. Alfred Wm. Knight, and those gentlemen were appointed life directors. There had been two other directors, Mr. Thos. Bacon and Mr. Roland Lee Knight, the latter gentleman being appointed secretary at a salary of £8 a week. Mr. A. W. Knight resigned from the board in January, 1923. The qualification of a director was the holding of 200 shares, and all the directors were duly qualified except Mr. R. Lee Knight, who was appointed without qualification by special resolution. Messrs. Mitchell and A. W. Knight received, in the first instance, a weekly salary of £6 10s., and, in addition, they were allowed £2 weekly for expenses, but in October, 1922, the salaries and allowances were consolidated and they subsequently received £500 per annum. By an agreement dated July 26th, 1920, the company acquired, as from April 2nd, 1920, the goodwill of the retail business of electrical engineers and manufacturers of wireless apparatus carried on by F. L. Mitchell & Co., Ltd., at 188, Rye Lane, Peckham; also a lease for 21 years of those premises at a rental of £85, rising to £90 per annum, the stock-in-trade, fixtures, fittings, and shop furniture, and the benefit of all existing contracts. The purchase consideration was £4,000, to be satisfied by the issue of 2,000 fully-paid shares and £2,000 in cash. The shares were divided between Mr. Mitchell (who received 1,500), and Mr. A. W. Knight (500), and the cash was to be handed over by instalments and used by F. L. Mitchell & Co., Ltd., in payment of their liabilities. A parcel of 200 further shares was issued as fully paid in March, 1923, as payment for a coil-winding patent then acquired by the company; 802 shares had been issued for cash, 500 of the number being taken by Mr. Bacon when he became a director in August, 1921. No independent valuation of the business taken over was made, nor was any balance sheet prepared, but Mr. Mitchell, one of the vendors, had stated that the business of F. L. Mitchell & Co., Ltd., was not making any profit. It was rather difficult at the moment to understand the object of the promotion; there was already one company in existence, and he (the chairman) could not conceive what advantage was to be gained by anybody by thus substituting one company for another. Reverting to the cash purchase consideration of £2,000, the chairman stated that part of it still remained unpaid. In order to obtain money, a loan of £550 was obtained from a third party, who was not connected with the company, and who, in return for the loan, received a debenture bond, bearing 5 per cent. interest per annum, as security. That bond was issued in January, 1922, and in the following December further debentures for £2,600 were issued to secure loans for the same amount, £2,300 of which was cash provided by Mr. R. Lee Knight, who joined the board of directors in that month, and also became secretary of the company. The first debenture of £550 and interest thereon was paid off from that fund. On May 10th, 1922, the company also took over the wholesale business of F. L. Mitchell & Co., Ltd., which branch was carried on at McDermott Road, Peckham. No consideration passed for that wholesale branch, and in December, 1922, the company acquired for the purpose of show-rooms other premises in Gerrard Street, W. The balance sheets and trading accounts showed during the first year, which ended on July 2nd, 1921, a gross profit of £3,471, but a net loss of £165 after charging to profit and loss account £1,064 in respect of advertising and catalogues, the sales for the year being returned at £11,970. In the following year the accounts showed sales £7,371, a gross profit of £2,586, and a net profit of £234; and those for the year ended July 5th, 1923, showed sales £28,476, a gross profit of £5,395, but a net loss of £2,719. On July 6th, 1923, Mr. R. Lee Knight, as debenture holder, appointed Mr. Edward Stanley Thorn, C.A., 68, Coleman Street, E.C., as receiver. That gentleman had since been in possession of the assets. He had disposed of the lease of 188, Rye Lane, for £650, and had sold a portion of the stock. He was realising the remainder of the stock and assets and hoped there would be a small surplus available for the unsecured creditors after paying the costs of the receivership and discharging the debentures. A statement of affairs showing the position at the date of the appointment of the Receiver had been prepared. It disclosed unsecured debts £5,489; preferential claims, £107; and debenture claims, £2,600; whilst the assets were estimated to produce £4,657; but it would not be wise to place too much value upon that figure, and they had the opinion of Mr. Thorn that in all probability there would be only a small surplus from the realisation for the unsecured creditors. The failure of the company was attributed by Mr. Mitchell to trade depression and to the fact that there was a Press compaign, in which people were advised not to purchase accessories or spare parts of wireless

outfits pending the settlement by the Post Office of negotiations with regard to licences.

Replying to the chairman, Mr. Mitchell said the company was formed because Mr. Bacon and other gentlemen were prepared to subscribe for shares if the sole management and control were placed in the hands of Mr. A. W. Knight, who was an acknowledged expert in wireless matters. The £2,000 cash consideration was paid to F. L. Mitchell & Co., Ltd., and devoted to paying off liabilities which, altogether, amounted to £4,700. He agreed that F. L. Mitchell & Co., Ltd., was a private company, the shareholders of which were himself, his wife, his brother (since deceased), and Mr. A. W. Knight. A resolution was passed for Mr. W. A. J. Osborne, accountant, Balfour House, Finsbury Pavement, E.C., to act as liquidator (with the assistance of a committee of inspection, consisting of Mr. Edward White, Mr. J. F. Sutton, and a representative of Radio Instruments, Ltd.).

Appended is a list of the principal creditors:—

UNSECURED—	£		£
Beldam Tyre Co., Ltd.	12	London Electric Wire Co. and Smiths, Ltd.	345
Brotschi Bros. & Co., Ltd., Grenchen, Switzerland	481	Ditto Stores, Ltd.	15
British Insulated & Helsby Cables, Ltd.	65	Jno. H. Lile, Ltd.	76
British Thomson-Houston Co., Ltd.	39	A. Mason	30
S. G. Brown, Ltd.	237	Metropolitan-Vickers Electrical Co., Ltd.	113
Burndept, Ltd.	13	F. L. Mitchell & Co., Ltd. ...	221
H. J. Bywaters	14	Mullard Radio Valve Co., Ltd.	33
British Broadcasting Co., Ltd. ...	250	*Motor Guide*	12
Butler, Viney & Co.	94	Jno. R. C. Miller	40
Cassell & Co., Ltd.	126	Napier Kimber, Ltd.	13
Concentric Manufacturing Co., Ltd.	101	Nettlefold & Sons, Ltd.	14
Cooper & Budd, Ltd.	92	New Eccles Rubber Works, Ltd.	27
F. C. Dowsett	11	Odhams, Ltd.	15
Geo. Dubois	19	G. H. T. Petersen, Ltd.	17
Electric & Ordnance Accessories Co., Ltd.	161	Pidgen Bros.	12
G. W. Evans & Co.	776	Radio Instruments, Ltd.	317
Ever-Ready Co., Ltd.	19	Radio Equipment Co., Ltd. ...	22
Gaskell & Grocott	67	Radiophones, Ltd.	58
G. H. Gledhill & Sons, Ltd. ...	55	Selfita Co., Ltd.	12
Alfred Graham & Co.	80	Siemens Bros. & Co., Ltd. ...	33
Hart Accumulator Co., Ltd. ...	85	G. F. Sutton	25
Haseltine, Lake & Co.	17	J. Stone & Co., Ltd.	83
Fredk. A. Hill & Co.	23	Hugh Stevenson & Son	47
M. Heussen & Co., Arnken, Holland	12	Geo. Sutton	103
F. A. Hughes & Co., Ltd. ...	30	W. C. Thorn Service	13
A. H. Hunt, Ltd.	61	Thorpe & Taylor	10
Igranic Electric Co., Ltd. ...	22	E. Walters & Sons	22
A. W. Knight	24	Wilks & Stanley	107
Lamson Paragon Supply Co., Ltd.	17	E. White	56
E. J. Larby, Ltd.	25	T. W. Young, Ltd.	46
S. G. Leach & Co., Ltd.	130	PARTLY SECURED—	
		Cochrane & Cripwell (Security valued at £21.)	35
		Preference	107
		Debentures	2,000

SUNBEAM LIGHT CO., LTD.—Winding up voluntarily. Liquidator, Mr. G. J. Millen, 13, Burstock Road, Putney, S.W.

CAR IGNITION AND LIGHTING CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. P. Cave, 29, Martin Lane, E.C.4. Meeting of creditors, January 2nd, at 29, Martin Lane, E.C. Particulars of claims to the liquidator, by January 31st.

SEMCO, LTD.—Particulars of claims by January 25th, to the liquidator, Mr. F. B. Darke, 146, Bishopsgate, E.C.2.

YORKSHIRE AND DISTRICT ELECTRIC LAMP REPAIRING CO., LTD.—A meeting of members is called for January 30th at 68, Eyre Street, Sheffield, to hear an account of the winding up from the liquidator, Mr. H. Cawood.

R. F. PAYNE, GALLWEY & CO., LTD.—A meeting of members is called for January 31st, at 1 and 2, Bucklersbury, E.C., to hear an account of the winding-up from the liquidator, Mr. T. S. Salaman.

PEARSON'S ELECTRIC MINERS' LAMP CO., LTD.—A meeting of members is called for January 23rd at 100 to 106, Moorgate Station Chambers, E.C., to hear an account of the winding-up from the liquidator, Mr. A. E. Green.

MIDLAND RUBBER CO., LTD.—Winding up order made by the High Court on December 18th.

Dissolutions of Partnership.—ETCHINGHAM MOTOR TRADING CO., motor and electrical engineers, &c., Etchingham, Sussex.—Mr. P. J. Ambrose and Mr. H. W. Vincent have dissolved partnership. Mr. Vincent will attend to debts.

WEYMOUTH & DISTRICT ELECTRICAL CO., electrical engineers, Bridge Chambers, Weymouth.—Mr. A. J. McMahon and Mr. J. Lewis have dissolved partnership. Debts will be attended to by Mr. McMahon.

Trade Announcements.—A. F. A. ACCUMULATORS, LTD., has removed to larger premises at 9a, Diana Place, Euston Road, London, N.W., where it will have increased facilities for battery manufacture and repair. Telephone number: "Museum 498"; telegraphic address: "Lindeline, Eusroad, London."

THE SCHOLEY CONSTRUCTION CO., LTD., has removed to 137, Victoria Street, Westminster, London, S.W.1. Telephone number: "Victoria 6855."

THE STELLA CONDUIT CO., LTD., of Bilston, has appointed Mr. J. Normington, 5, Victoria Park, Shipley, as its Yorkshire agent, and Mr. T. M. Davies, 87, Whiteladies Road, Bristol, as agent for the South-East Coast.

Messrs. HANS RENOLD, LTD., of Manchester, have taken more adequate London accommodation at Bush House, Aldwych, W.C., where stocks will be carried. Telephone number: "8476 City."

Messrs. MARKES, WARD & CO., LTD., of Islington, notify a change of telephone number to "North 4470."

THE WEST LANCASHIRE ELECTRICAL CO., LTD., has removed its business at Southport to 4, Post Office Avenue, where new showroom premises have been constructed.

Messrs. R. BIRD, CHEVERTON & DAYS, LTD., Castlehold, Newport, Isle of Wight, have taken over the wireless business of Mr. G. H. Lewis Norman, High Street, and Mr. Norman has been appointed manager of the firm's wireless department.

Messrs. POLLARD & SMITH, district agents for several electrical companies, have removed from Albert Square to larger premises at 95, St. James Street, Oxford Street, Manchester. Until September last Messrs. White, Andrews & Co., Ltd., and Mr. Charles White occupied separate parts of the same premises at 5a, Fye Foot Lane, E.C.4, but, though somewhat similar in name, there was no connection between the two businesses. Mr. White informs us that since his removal to 26, Upper Thames Street, E.C.4, in September, there has been some confusion in the postal communications, and he asks us to say that the two businesses are in no way connected.

MR. JAMES W. HALL has transferred his office from Cannon Street to his new works at Sutton: Switchgear Works, Gander Green Lane, Sutton, Surrey. Telephone No.: Sutton 1764. Telegraphic address: "Halswitch, Sutton."

Messrs. NEWTONS, of Taunton, makers of direct-current dynamos and motors, announce that on and after January 1st, 1924, their Sales Department will be transferred from Victoria Road, Willesden Junction, N.W.10, to their works at Taunton, to which address all correspondence and inquiries should be sent. The Accounts Department will remain at Willesden.

Catalogues and Lists.—Messrs. FRANK V. COLLINS & CO., 155, Kingston Road, Wimbledon, S.W.19.—A series of pamphlets advertising "Revo" electric fires, &c., "Osram" lamps, and G.E.C. Christmas gifts.

WESTINGHOUSE ELECTRIC INTERNATIONAL CO., East Pittsburgh, Pa., U.S.A.—A well-illustrated brochure dealing with small motors and their applications; and a publication dealing with correct illumination.

THE STERLING VARNISH CO., 196, Deansgate, Manchester.—A folder advertising "Nitrex," a preparation for preserving spare tires, &c.

Messrs. HERBERT MORRIS, LTD., Loughborough.—A priced and illustrated booklet containing particulars of electric hoist blocks of various patterns.

ENGINEERING AND LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans, Herts.—List No. P. 1,223, in which many types of weatherproof and watertight lanterns are illustrated, including fittings for gasfilled lamps. Priced.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C.4.—A priced booklet dealing with "Luxor" lighting fittings, and containing coloured illustrations of silk shades for these.

THE H.R. GEAR CO., LTD., 20, Conduit Street, W.1.—A brochure describing "H.R." reduction gears for various purposes. Illustrated and priced.

Calendars, Diaries, &c.—The HART ACCUMULATOR CO., LTD., of Marshgate Lane, Stratford, London, E.15, has issued its usual desk blotting pad, which will enforce the user to see "red" (and gilt lettering) during the coming year. From the same company we have received a wall calendar, consisting of very large monthly sheets (with bold figuring), above which appear illustrations of "Hart" batteries for various classes of service.

A calendar received from Messrs. PARSONS BROS., Gloucester, has monthly sheets in blue and white.

From Messrs. FRANK V. COLLINS & CO., 155, Kingston Road, Wimbledon, S.W.19, there has come to hand a small wall calendar with little monthly slips below a coloured print showing "The World Forgotten" in the rapture stirred in the soul by the music from a violin.

THE SUN ELECTRICAL CO., LTD., has sent us a packet of daily slips for a metal stand received last year.

A pocket diary of convenient size, containing postal information, automobile registration letters, &c., has been sent us by Mr. CHARLES SELZ, Baker Street, W., silk lamp shade manufacturer.

The calendar published by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, for 1924, consists of monthly sheets, each bearing an illustration of the firm's turbo-generators, switchgear, motors, and other products.

Messrs. MATHER BROS., Farringdon Street, E.C., have again sent us a calendar with a date-marking device upon monthly sheets.

A calendar with large-figure daily slips has arrived from Messrs. T. J. GRAINGER & CO., LTD., Newcastle-on-Tyne.

Messrs. LINDSAY & WILLIAMS, LTD., of Manchester, have issued a wall calendar for 1924 with a set of daily slips with large figuring.

Mr. L. W. FOOTE, of 73, Plymouth Road, Penarth, have sent us a wall calendar with monthly date slips. "Betty" reminds us that it is not always winter-time.

THE ENGLISH ELECTRIC CO., LTD., of Queen's House, Kingsway, London, W.C.2, has issued a calendar for either the desk or the wall, with a block of daily slips for 1924, on a stout card.

A somewhat different note is struck by the calendar received from the Staffordshire Electrical Accessories Co., Ltd., Hanley. This has weekly date slips, each with an improving quotation.

The Nottingham Society of Engineers has issued a pocket diary for 1923-1924 with an insurance coupon in the front pocket. The list of officials and members and a section for daily engagements precedes a Lett's diary with daily note spaces, useful tables, &c.

A handsome art metal calendar stand, with monthly cards and a date-cancelling arrangement, has been sent us by the Reason Manufacturing Co., Ltd., Brighton.

Book Notices.—"Telegrafia e Telefonia senza fili," by P. Barreca. Pp. xix+450, illustrated. Livorno: R. Giusti. Price 18.50 lire.

"Practical Electrician's Pocket-Book, 1924." (Pp. xci+570 and diary). London: S. Rentell & Co., Ltd. Price 3s. net. Apart from the alterations and additions which have been made to bring this pocket-book up to date, the twenty-sixth edition varies little from its immediate predecessor. The principal changes are in the Turbines and Water Power section, which has been rewritten, and the chapter on Broadcasting, which has been revised and enlarged.

"*Mechanical World* Year-Book, 1924." (Pp. 172+348 and diary.) Manchester: Emmott & Co., Ltd. Price 1s. 6d. net.—The principal new feature in this, the 37th edition, is a section of 12 pages upon the combustion of fuel. In this the chemistry of the combustion of the various constituents of solid and liquid fuels is treated in a brief manner, although the explanations are of sufficient length for the average engineer. Other points dealt with include the analysis of flue gases, the calculation of the weights and volumes of the products of combustion and the air actually used, calorific values of coal and liquid and gaseous fuels, &c. Other new sections are those dealing with the strength of flat plates and tanks.

The *Practical Engineer*, which was established in 1887, and has this year been published from the offices of *The Engineer*, ceases publication as from Thursday, December 27th.

"Railway Amalgamation in Great Britain," by W. E. Simnett. (Pp. 276.) London: *The Railway Gazette*. Price 15s. net.—This is a very detailed exposition of the factors which led up to the grouping of railways by the Railways Act of 1921, and the methods by which this was carried out. The author is well qualified to deal with the subject as he was a member of the Railways Amalgamation Tribunal to which the huge task of grouping was entrusted. To students of transportation history the book should prove of the utmost value.

"Matriculation Magnetism and Electricity," by R. H. Jude, M.A., D.Sc., and John Satterley, M.A., D.Sc. (Pp. 415; 234 figs.) London: University Tutorial Press, Ltd. Price 6s. 6d.—This is a second edition of a work suitable for use in secondary or public schools. It is divided into three parts, dealing respectively with magnetism, electrostatics, and electrodynamics. The present edition has been slightly enlarged by the inclusion of a few pages containing fuller information regarding the telegraph and telephone.

The F.B.I. and Taxation.—The Committee appointed by the Federation of British Industries, with wide terms of reference, to consider the whole question of central and local taxation and administration, particularly with regard to the desirability of decentralisation of control and of greater industrial representation on local authorities, has issued a report. Broadly, the committee, after reviewing the situation which has arisen as a natural result of the war, considers that central control of local expenditure, with its necessity for inspectors and inflation of staff generally, leads to overlapping and extravagance of administration. As a particular example of this, the administration of funds for the relief of distress and unemployment is quoted. Special services, which, it is not denied, are from a social point of view eminently desirable, have added to the burden of the rates, and unprofitable municipal trading undertakings are also blamed for a great part of the increase. The committee recommends a relaxing of the control exercised by the Government over local authorities, suggesting, as a safeguard, that power should be given to the Ministry of Health to suspend a local authority proved to have been guilty of extravagance and abuse of its powers. There is said to be a need for a Commission to examine the incidence of taxation with a view to a more just distribution of the burden, and, finally, the committee urges industrialists and suitable members of their staffs to take more interest in local Government and themselves serve on local bodies.

Damaged Japanese Factories.—We have received from the Japanese Ministry of Agriculture and Commerce a report of the Ministry's Industrial Bureau upon the damage caused to factories by the recent earthquake. It states that the works of the Meidensha Co., at Ozakicho, suffered little damage on the whole, but the walls of the department devoted to the manufacture of large electrical machinery are cracked and the foundations of the heavy machinery have slipped, making readjustment necessary. The output of smaller machines will suffer no change, but some time is needed for the reconstruction of the factory for large machines.

Little damage was done to the Oil factory of the Tokyo Electric Co., which manufactures electric lamps. Work is held up for lack of gas, which is used to melt the glass. The same company's Kawasaki factory suffered severe damage. The laboratories and engineering shops collapsed, killing several employés, and stocks of materials and manufactured articles appear to have been destroyed. The manufacture of the better-class lamp which was carried on there has been transferred to the Oil works.

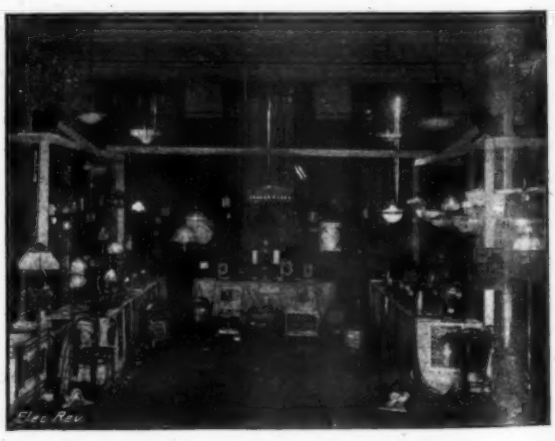
The electrochemical works of the Asahi Denka Kogyo (Asahi Electrical Industries) received slight damage, a boiler room and a warehouse collapsing. Several rubber factories were affected to a small extent; the Japan Cycle Rubber Co.'s Zeshigaya factory warehouse was partially destroyed, but a number of telephone instruments in stock were undamaged. The Kojima Hard Rubber Manufacturing Co. sustained little loss. The Tokyo Electric Hatagaya Works were only slightly damaged, and work was soon resumed in electric lamp manufacture.

Large Railway Expenditure.—It is announced that the London & North-Eastern Railway Co. is to spend nearly £5,500,000 during 1924. The programme includes the construction of new rolling stock of all classes. Four complete dining-car trains are to be built for the King's Cross-Edinburgh route, and in these the cooking will be done entirely by electricity.

United States Trade with British Empire.—The dependence of the United States upon the British Empire for many staple products is shown in an article contributed to the November *Journal* of the British Empire Chamber of Commerce in the United States of America by Mr. R. A. Watson. He states that 90 per cent. of the rubber imports comes from British territory; 99 per cent. of the jute imports; 94 per cent. of the imported block tin; and 93 per cent. of the shellac procured from abroad. "Many products of comparatively small value in themselves, but of enormous value to our great industries, we also secure from British territory; such, for example, is mica. Ninety per cent. of our total imports are procured from the British Empire. Think of our vast electrical and telephone business without this product."

Electrical Porcelain for Chile.—A short report on the market for electrical porcelain in Chile has been issued by the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. United Kingdom firms desirous of obtaining a copy of this report should apply to the Department, quoting reference 9113/F.L./M.C./2.

Local Exhibition.—South Shields.—The borough electrical engineer informs us that the municipal electrical exhibition recently held in the town was very successful, resulting in an influx of applications for supply much above the normal. The accompanying picture shows a corner of the display.



The South Shields Electrical Exhibition.

Coal Meters.—Among contracts recently received by the Lea Recorder Co., Ltd., for its coal meters are repeat orders from the Derby, Halifax, Grimsby, Wallasey, Bedford, and Tunbridge Wells Corporation electricity works; Charing Cross, West End, and City Electric Supply Co., Ltd.; South Metropolitan Electric Supply Co., Ltd.; Clyde Valley Electrical Power Co.; also numerous other contracts from Australia, South Africa, China, and Japan.

For Sale.—Offers are invited for the generating plant at the R.E. Experimental Station, Porton, near Salisbury. Navan Urban Council has for disposal surplus generating plant, overhead main poles, meters, &c. (See our advertisement pages to-day.)

Patent Application.—Application has been made for the restoration of Patent No. 30,478, of 1909, for "Improvements in or Relating to Pyrometers," granted to Charles Edwin Foster.

Selling Prices in France.—In the course of their report for 1922-23 the directors of the Société d'Electricité de Paris, which owns the large station at Saint-Denis, state that they have drawn attention on various occasions to the necessity for making great additions to the redemption and renewal funds. The economic situation, they say, does not permit of foreseeing an early reduction in the cost of anything. On the contrary, the prices charged by industry in general, and particularly in the electrical construction industry, are increasing. Under these circumstances the company will have to reckon with higher prices for all the plant which will have to be renewed.

New Australian Company.—The Enfield Cable Works (Australasia), Ltd., with a nominal capital of £5,000 in £1 shares, has been formed in Australia to carry on the business of manufacturers of, and dealers in wires, cables, and other accessories in the electrical and similar trades. Messrs. A. E. Flaskett and H. Brown are the first directors.

Manufacturing in France.—The report of the Société Industrielle des Téléphones, whose financial results were recently recorded in this journal, states that, despite very keen competition, the company's various works were largely provided with orders in 1922-23, with the exception of the factory in the Rue des Entrepreneurs, which continued to suffer from a lack of orders from the State Postal Administration. A modification of this situation would now take place, as considerable credits had been asked of Parliament for the improvement of the network and the telephone equipment in Paris and in the departments, and one instalment of 700,000,000 francs had already been granted. Concerning the acquisition of the "Continental" works at Clichy, the report states that this works began operations in November, 1923, although a year would elapse before it was brought into full activity. Similarly, the Paris-Anzin works, which had also been taken over, was expected to be at work next February, when it would be possible to undertake the manufacture of the long-distance cables included in the Post Office programme. In conclusion, it is mentioned that the directors, in conjunction with certain other firms, have formed two companies for the execution of the long-distance telephone cable schemes and the financing of the works.

Irish Free State Fiscal Policy.—Electrical goods importation was among the subjects dealt with by the Irish Free State Fiscal Inquiry Commission, which has now reported against a policy of protection, urging, however, by way of suggestion only, that in certain circumstances bounties, either on production or export, might be less objectionable than import duties. It is urged that protective tariffs would increase the cost of living, and it is pointed out that wages are higher in the Free State than in Great Britain and Northern Ireland, to the handicap of home industry. The Commission, while making no specific recommendations, thinks that fiscal alterations in other countries, particularly in those with which the Free State is politically associated, might demand a change in policy.

Electrical Plant for Brazil.—The construction of electric light plants is being contemplated by the authorities of a number of municipalities in the State of Rio Grande do Sul, Brazil. The policy of municipal ownership of this utility is quite common and the financial condition of most of the towns is such that they can readily pay over a period of 10 or 15 years for the equipment necessary for electric lighting installation. German competition in this section of Brazil is keen, since German individuals are frequently in control of the electric light companies or prominent in the promotion of municipal projects. It has been noted, however, that several firms have been unable to get delivery of orders placed in Germany during the past eight or ten months.—*Commerce Reports.*

Dutch Foreign Trade.—Increased activity in the importation into Holland of machinery, especially electrical machinery and equipment, is reported by the United States Consul-General at Rotterdam. Imports of generators during the first nine months of the current year amounted to 3,391 metric tons in 1922 and to 3,980 tons this year, Germany furnishing three-fourths of the total. Miscellaneous electrical installations increased from 93 to 124 metric tons; telegraph and telephone apparatus decreased from 1,857 to 1,810 metric tons, and other electrical apparatus decreased from 3,352 to 2,910 metric tons. The export of electric light bulbs during the first nine months of the current year amounted to 3,391 metric tons, as compared with 2,400 metric tons in the same period of 1922. The exports in September this year amounted to 485 metric tons, as compared with 347 metric tons last year. The industry is in a prosperous condition, and is constantly widening its export markets.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned below.

W. R. S. A Message for You (lettering and design). No. 249,611, Class B. Instruments and apparatus for wireless telegraphy and telephony, but not electric cells and batteries.—John V. Waine, The Firs, Compton Road, Compton, near Wolverhampton. December 19th, 1923.

Herbo. No. 441,961, Class 8. Apparatus for use in wireless telegraphy and telephony.—Herbert Bowyer, trading as Herbert Bowyer & Co., 1a, Railey Mews, Leverton Street, London, N.W.5. December 19th, 1923.

Scorpio. No. 440,225, Class 13. Electric Lamps, Plant and Supplies, Ltd., 12-13, Henrietta Street, London, W.C. December 19th, 1923.

Biflector. No. 442,042, Class 13. Electric fittings.—The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N. December 19th, 1923.

Lead.—Messrs. James Forster & Co. state that apart from the uncertainty of the position of affairs in Mexico there is little at the moment to justify the very high values now ruling. Should, however, the Mexican revolution take a turn for the worse, the position of supplies here would become serious, as we are now getting an average of 5,000 tons a month from that quarter, all of which in the past has been wanted by the trade.

Service Notes.—It is officially intimated that Colonel R. E. B. Crompton, C.B., Hon. M.I.E.E., honorary colonel of the London Electrical Engineers since June, 1911, has been transferred in a similar capacity to the 11th London Electrical Engineers, which was formed in October, 1922, under the command of Lieutenant-colonel K. W. E. Edgecumbe, M.I.E.E. Colonel Crompton, who formerly served in the 57th Middlesex Regiment, the famous "Diehards," was in command of the Electrical Engineers in the South African War, 1900, was mentioned in dispatches, and given the C.B., and Queen's Medal with three clasps. His new appointment dates from December 19th. Mr. J. H. N. Brooke has been granted a commission in the Royal Air Service as a pilot while engaged with the Electrical Service Works Company, under the Directorate of Works and Buildings. Telegraphist-Lieutenant R. H. W. Westcott, Royal Navy, has been appointed to the charge of the radio station at Jamaica from New Year's Day.

Dielectric Piezo-Electric Effects.—A paper dealing with investigations of piezo-electric effects with dielectrics was read by Mr. K. R. Brain, B.Sc., before the Physical Society of London recently, which describes experiments on the piezo-electrification of dielectrics, *i.e.*, ebonite, glass, hornoid, sealing wax, rubber, celluloid, and hard paraffin. The relation of quantity to load was determined; with sensitive specimens the magnitude of the charge is of the same order as that found by Curie with crystals. Fatigue and hysteresis effects in the dielectrics were established. Experiments on cubes showed a dissymmetry in results, suggesting an irregularity of structure. The general similarity of the behaviour of the dielectrics to that of crystals leads to the assumption that they possess a quasi-crystalline character, and the effects are explained on this assumption, which has been verified by X-ray photographs.

Unemployment.—There was a further decrease in the number of unemployed during the week ended December 17th. The total number of persons registered as totally unemployed on that date was 1,137,100, as compared with 1,180,295 a week previously. Since January 1st there has been a decrease of 348,778 in the total. There was also a decrease in the number of "short-time" workers, the figure being 54,400 on December 17th, as compared with 58,551 on December 10th. The total was, however, greater than at January 1st.

The *Ministry of Labour Gazette* states that employment in the engineering trades remained bad on the whole during November, but showed a tendency towards improvement. In marine and textile engineering it continued very depressed, but in the railway, electrical and printing machinery sections it remained fair, and the motor section showed an improvement. Employment in the shipbuilding and ship-repairing industries continued very bad. The lock-out of platers, rivetters, &c., at the yards of members of the Shipbuilding Employers' Federation terminated on November 24th, but some time may elapse before work can be fully resumed. Employment in the other metal trades was moderate on the whole, but showed some improvement in certain sections. Unemployment in the electrical engineering industry was comparatively low, being only 6.4 per cent., as compared with a total of 18.9 per cent. for engineering as a whole.

Glow Lamp Production in Sweden.—The 25th year of its existence has just been celebrated by the A. B. Skandinaviska Glödlampfabriken of Nykoping, which began the manufacture of gasfilled lamps in 1923. When the works was first started there was a glow lamp factory already in existence, but this was subsequently discontinued. At the present time there are three firms in Sweden who make incandescent lamps.

New Year Holidays.—The works and offices of Messrs. Browett, Lindley & Co., Ltd., Patricroft, will be closed from noon on Saturday, December 29th, until the morning of Wednesday, January 2nd.

Business Conditions in America.—The representative in London of the Irving Bank-Columbia Trust Co., New York, has received a cable from headquarters stating that the pig-iron output in the U.S.A. in November was 2,894,000 tons—a low record for the present year. Silk consumption amounted to 25,225 bales—the lowest monthly record since May. Woollen and worsted industries are dull and hosiery and knit goods in poor demand. Unemployment is increasing. Bituminous coal production has decreased, and the petroleum

output is now the lowest since June. Automobile production for the first eleven months of 1923 was 3,718,000—the highest on record. Building activity has increased. November failures numbered 1,644, with capital involved $67,536,000. A large number of banks suspended payment during November in the West, particularly in North Dakota and Oklahoma. These account for 34 million dollars liabilities.—*Board of Trade Journal.*

British Empire Exhibition Notes.—A Fellowship of the British Empire Exhibition has been formed, with the Prince of Wales as president. The object of the association is the recruiting of men of all parties to assist Empire trade and industry. The subscription has been fixed at two guineas, and for this members will receive a parchment certificate of membership, a badge, and a season ticket for the Exhibition (or, alternatively, 25 single tickets). The offices of the Fellowship are at 16, Grosvenor Gardens, S.W.1. In connection with the scheme there will be instituted prizes and scholarships, which will be available only to Fellows or their nominees.

The Fulham Borough Council has intimated to the British Electrical Development Association that the Electricity Commissioners have sanctioned a contribution of £200 from the funds of the electricity undertaking towards the cost of the Association's display at the Exhibition.

Protection of Trade Marks.—The Committee of the International Chamber of Commerce for the Protection of Industrial Property met at Paris on December 14th and 15th. The International Convention dealing with this matter was last revised at Washington in 1911, but experience having proved that it is now insufficient, it will shortly again be revised at The Hague. The International Chamber of Commerce adopted, in March, a series of amendments which industrialists and business men hoped would be introduced in the convention while the Economic Committee of the League of Nations has also proposed amendments. The Committee of the International Chamber of Commerce was to endeavour to draft texts ensuring the most effective protection against the mis-use of trade marks, false indications of origin, imitations, &c. It also examined the question of the institution by States of criminal proceedings abroad in the case of unfair competition of this kind. The question of the international protection of patents figured on the agenda. The findings of the Committee will be communicated to the League of Nations and will doubtless be taken into consideration at the Hague Conference of 1925. Mr. Robert Burrell, secretary of the Trade Marks, Patents and Designs Federation, represented Great Britain.—*Reuter* (Paris).

The League of Nations has just invited a number of Governments to send representatives to a meeting of experts to be held in Geneva on May 5th, 1924, to discuss an international draft convention aiming at the suppression of unfair competition in international trade by the improper use of trade marks, false indications of geographical origin, and other such abuses.—*Financial Times.*

Large Canadian Orders.—The *Electrical News* (Toronto) states that the following orders have been placed by the Southern Canada Power Co. in connection with its hydro-electric development at Hemming's Falls:—With the Canadian General Electric Co.: Two 6,000-kVA. 3-phase, 2,200-V, 150-r.p.m., vertical-type generators; four 6,000-kVA. 3-phase, 6,600-V, 150-r.p.m., vertical-type generators; twelve 2,000-kVA. single-phase, 6,600/48,000-V. water-cooled transformers. With the Dominion Engineering Co.: Six 150-r.p.m. turbines, vertical type, capable of developing 6,300 h.p. at 55-ft. head. The generators are rated at 6,000 kVA, 4,800 kW, at 80 per cent. power factor.

A "C.T.S." Competition.—By arrangement with the proprietors of *Electricity*, the St. Helens Cable and Rubber Co., Ltd., has organised an essay competition, the subject of which is the advantages and disadvantages of the "C.T.S." system of wiring.

LIGHTING AND POWER NOTES.

Ammanford.—Purchase of Undertaking.—The Urban District Council has purchased the privately-owned electricity undertaking in the district at a cost of £17,460.

Australia.—Tasmania.—The Tasmanian House of Assembly has voted a sum of £31,000 to establish a sub-station at Lake Margaret and erect a transmission line from there to Zeehan (on the west coast) for the purpose of supplying electrical energy to the Electrolytic Zinc Co.'s ore-treatment works at Zeehan.

Bath.—New Plant.—The Electricity Committee has recommended to the City Council that application be made to the Electricity Commissioners for sanction to the borrowing of £80,000 for the installation of two 3,000-kW turbo-generators, with the necessary boilers and auxiliary plant.

Birmingham.—Electricity Supply.—At a recent meeting of the Electricity Committee it was reported that the supply of electricity during November was abnormal. The demands for power purposes had been exceptionally heavy, while the number of new consumers exceeded 600. Despite the prevailing trade conditions, the consumption during 1923 has exceeded the highest demand in the war period. It is the intention of the department, in view of the increasing requirements, to install additional plant in the near future.

Brazil.—New Power Station.—The Brazilian Traction, Light, and Power Co. is constructing a new power station about 100 miles from Rio de Janeiro, with a capacity of 160,000 h.p.

Bristol.—Change-Over.—With a view to providing work for the unemployed, the Corporation is to change over its system of supply in the Fishponds and Brislingdon areas from single to 3-phase at an estimated cost of £40,619.

Cambuslang.—Electricity Extensions.—The Lanarkshire County Council has decided to expend over £6,000 on extensions to the electricity works.

Canada.—Winnipeg.—On October 15th last the channel of the hydro-electric development at Whitemud Falls was opened by the blowing up of the cofferdams. The development, which has been carried out by the Manitoba Power Co., consists of the concentration of the waters of the Winnipeg River at seven sites, rendering available a total power of 313,000 h.p. with regulated flow, or 420,000 h.p. for the whole river, including existing developments.

Ceylon.—Hydro-Electric Development.—Little has been heard of late of the proposal to inaugurate several large hydro-electric installations in Ceylon. The Government some few months ago decided to refer the matter to an expert committee. The Mahaweliganga River is stated to be capable of developing 70,000 h.p. at a point about 12 miles from Peradeniya, which is 24 miles from the Abamwela Railway and 20 miles from Nanuoya. A further 30,000 h.p. might be developed about a mile below this point. The following are the approximate capacities of stations which could be erected in Ceylon:—About eight miles from Kandi, 12,000 h.p.; Kotmalieoya, 6,000; Ulapane, 15,000; Aberdeen Falls, 10,000; Kitulgala Rapids, 50,000. This last source is only 42 miles from Colombo. There are several other smaller water powers which it might pay to develop. The smaller towns of Gampaha Peliyagoda, Minuwangoda, Jaela, Kochchikade, and others have already installed plants, all oil-driven, but when the larger scheme is in operation these oil engines will be replaced by transformers.

Continental.—France.—At a recent meeting of the mayors of the district of the Bourbonnais, called to consider the question of the electrification of the townships, it was decided to nominate an expert to make a survey, the cost of which the mayors pledged the residents to defray. It was mentioned that the Société Forges de Gueugnon, which owns a large station built during the war, had a surplus of electrical energy which would be available for the working of the scheme.

Earby.—Electricity Supply.—The Council is applying to the Electricity Commissioners for the exclusion of its area from the West Riding Electricity District on the ground that there is no community of interest between Earby and the West Riding. It is thought that it would be more economical to be linked up with the Mid-Lancashire District, as Colne is only five miles away, whilst Keighley, the nearest generating station under the West Riding scheme, is 18 miles away.

East Midlands Electricity District.—Order of Confirmation.—With reference to the local inquiry held by the Electricity Commissioners at Nottingham on July 10th last in respect of the draft Order and scheme for the reorganisation of the supply of electricity in the above-mentioned district, the Commissioners have made an Order giving effect to the scheme approved by them, which has been submitted to the Minister of Transport for confirmation.

Exeter.—Electricity Supply.—The Electricity Committee has recommended that a sub-committee be appointed to consider terms that might be offered to the Crediton Urban District Council for a supply of electricity in bulk. It was also recommended that a special meeting of the Committee be held to consider proposals for extensions to the power station.

Fareham.—Electricity Supply.—The Urban District Council has received a proposal from the Portsmouth Corporation, that the Council should in future obtain its electricity supply from Portsmouth, utilising the Fareham electricity works as a distributing station. The Council has appointed a committee to negotiate with the Portsmouth Corporation on the matter.

Fordingbridge.—Proposed Electricity Scheme.—Mr. Royce, representative of a firm of electrical engineers at Wareham, attended a meeting of the Rural Council last week, and explained an electric lighting scheme for Fordingbridge. He stated that the approximate cost was £15,000, and that if the Council supported the scheme the work would be commenced immediately after Christmas. The Council decided to consider the matter at its next meeting.

Hamilton.—Transfer of Undertaking.—The Town Council has decided to take over the electricity undertaking of Edmundson's Electricity Corporation, Ltd., at the termination

of the present agreement. With this in view, the consulting engineers are to report on the condition of the plant, cables, &c., and the Town Chamberlain is to report on the financial state of the undertaking.

Hove.—NEW PLANT.—The Council is to install a new 600-kW motor generator and five h.p. cubicles at a cost of £4,260. The order for the plant has been placed with the Metropolitan-Vickers Electrical Co.

India.—HYDRO-ELECTRIC SCHEME.—The chief engineer, Irrigation Branch, P.W.D., Hyderabad, has issued a note on the possibility of projecting a hydro-electric scheme in the Adilabad district. The investigation of this scheme was undertaken at the instance of the Director-General of Commerce and Industries; and the preliminary survey was made by Mr. Ottley, the divisional engineer. It is proposed to develop the Kaddiam River both for irrigation and power. The drainage area measures some 920 sq. miles, of which the supply from 370 sq. miles is to be used for generating power, with a fall of nearly 400 ft.; and of the remainder, further storage, to be used for irrigation, is contemplated on the Cheepamani tributary. There will be two separate power stations, one near Bawajipet to utilise the supply from Gandivagu, and the Kaddiam-Nagarmall reservoirs; and another lower down on the foreshores of the main Kaddiam reservoir, to utilise the waters of the Cheepamani. The approximate falls obtainable for power are 380 ft. for the Bawajipet station, and 125 ft. for the Cheepamani station. The estimate of continuous power available at the two stations are :—Upper station, 7,500 h.p.; and lower station, 2,100 h.p.

SMALL POWER SCHEMES.—Recently the Jallunder Electric Supply Co. and the Shikarpur Electric Supply Co. installed 100-kW stations. The prime movers are of the Diesel type, by Mirrlees, Bickerton & Day, Ltd., direct-coupled to alternators running at 250 r.p.m. and generating at 2,200 volts.

Irish Free State.—THURLES (CO. TIPPERARY).—The Urban Council has endorsed the recommendation of the Electricity Committee adopting the alternating-current scheme proposed by the Ministry of Industry and Commerce, and has ordered Messrs. Tierney & Co., Dublin, to prepare the necessary plans and specifications.

Keighley.—ELECTRICITY IN BULK.—The Electricity Committee has recommended that, subject to the sanction of the Electricity Commissioners, the agreement with the Bingley Urban District Council for the supply of electricity in bulk be renewed for a period of ten years from April 1st, 1924.

Kingston-on-Thames.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £31,313 for electricity purposes.

London.—ST. PANCRAS.—Owing to the growth of the d.c. load on the King's Road power station, the Electricity and Public Lighting Committee recommends the installation of two 1,500-kW motor converters at the station in lieu of the two 1,000-kW sets already sanctioned, subject to the approval of the Electricity Commissioners. The estimated additional cost will be £700.

HAMMERSMITH.—*Bulk Supply to Chiswick E.S. Corporation.*—In order to take a larger bulk supply from the Council's station, the Chiswick Electricity Supply Corporation proposes to install an additional motor converter at its works, subject to the Council's agreeing to extend the high-pressure switchgear at the works which was originally installed by the Council.

Repairs to Plant.—Following upon a report upon the condition of the plant by the borough electrical engineer, the Electricity Committee recommends that a separate Repairs Department be established under a responsible engineer selected from the present staff.

Melksham.—ELECTRICITY AGREEMENT.—The Urban District Council has sealed an agreement consenting to the application of the Western Electric Distributing Corporation, Ltd., for a Special Order authorising it to supply electricity in the town.

New Zealand.—HAWKES BAY.—Plans for an electricity scheme for the district have been prepared by Messrs. Vickerman & Lancaster, consulting engineers. The estimated cost of carrying out the work is £100,000.

Northern Ireland.—COALISLAND.—The Commission on the Natural and Industrial Resources of Northern Ireland has issued an interim report. It deals mainly with the coal-producing possibilities of the Lough Neagh district, and with the development work carried out by Sir Samuel Kelly. It recommends that the greatest measure of State assistance should be given at once for the purpose of providing housing accommodation, water supply, sanitation, transport, and other purposes necessary in connection with the Coalisland development. The report further states that the Commission is advised (and presumably agrees) that it will be possible to utilise for the purpose of power generation the small coal which will not be marketable as such; that the electrical power thus generated could be produced at a cost of one penny per kWh; and that by a system of high-pressure transmission the power could be conveyed to most parts of Northern Ireland.—*Irish Engineering.*

OMAGH (CO. TYRONE).—The Urban District Council has appointed a committee to report as to the practicability of introducing electricity in the district.

Oban.—LOAN.—Application has been made to the Electricity Commissioners by the Town Council for sanction to the borrowing of £3,978 for electricity purposes.

Price Reductions—Reductions in the charges for electricity have been made in the following districts :—

BERMONDSEY.—Lighting : From 7d. to 6½ per kWh.

KINGSTON-ON-THAMES.—Heating and cooking : From 2½d. to 1½d. per kWh.

CHICHESTER.—Lighting : A reduction of 1d. per kWh. Power : A reduction of ½d. per kWh.

WESTON-SUPER-MARE.—Lighting : First 40 kWh per quarter, 8d. per kWh; next 50, 7½d. per kWh; next 50, 7d. per kWh, and 6½d. per kWh beyond, with a discount of ½d. per kWh for prompt payment of accounts.

COLWYN BAY.—Lighting : From 8d. to 6d. per kWh. Power : From 3½d. to 2½d. per kWh.

Rugeley.—ELECTRICITY SUPPLY.—As a result of the canvass of the residents of the town, it is found that 50 per cent. are in favour of an electricity supply, and the Urban District Council has decided to ask the Cannock Council if it will again receive a deputation for the purpose of considering the matter further and arranging an interview with the Electricity Commissioners.

Scotland.—ELECTRICITY ORDER.—The Scottish Midlands Electricity Supply, Ltd., has informed the Stirling County Council that it is applying for an Order, authorising it to supply electricity in certain parishes in Stirlingshire and portions of the counties of Clackmannan and Linlithgowshire.

Stourport.—NEW POWER STATION.—A grant of £700,000 has been made by the Treasury for the new power station of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. A 32-acre site has been acquired on the Severn at Stourport, near the junction of the Severn and the Stour. The foundations of the station were begun three months ago. It will have, eventually, a capacity of 200,000 h.p., and ultimately will supersede the existing four stations of the company at Smethwick, Dudley, Kidderminster, and Redditch, though the Smethwick station may be continued in commission for some years. The station will be the centre for the distribution of electricity from Stourport to the Black Country. Transmission lines will be constructed to Bromsgrove and further to the south of Worcestershire, and also into Shropshire. Twenty-five miles of overhead and underground transmission lines conveying current at 33,000 V will be laid. Further extensions are projected to Evesham and Pershore.

Swansea.—ELECTRICITY AGREEMENT.—Swansea Electricity Committee has approved a new agreement between the Corporation and the Harbour authorities increasing the maximum demand supply of electricity given to the docks from 1,000 kVA to 2,500 kVA.

United States.—LARGE POWER SCHEMES.—The Minnesota Power and Light Co. will shortly commence work on an extensive hydro-electric development programme for North-East Minnesota, involving an estimated outlay of $35,000,000. The Montaup Electric Co., of Pawtucket, R.I., is to erect a power station at Somerset, Mass., at a cost of $10,000,000.—*Reuter's Trade Service* (New York).

Worcester.—PROGRESS OF EXTENSIONS.—The chairman of the Corporation Electricity Supply Committee reported at a recent meeting of the Town Council that the total estimates for the whole of the work in connection with the transfer of the Southampton electrical plant was £57,060, and the expenditure to date had been £55,150. The whole of the Southampton plant had been removed to Worcester, and had been re-installed, with the exception of the 40,000-gallon feed pump. This work was now in progress, and the whole of the plant should be in commission by the end of January.

Yarmouth.—ELECTRICITY EXTENSIONS.—In order to meet the increased demand for electricity, the Corporation proposes to carry out the following works :—The installation of a new Babcock & Wilcox boiler at a cost of £6,000; laying of mains, £6,000; and house services, £3,000.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—YEAR'S WORKING.—The annual report of the general manager (Mr. Charles Furness) for the year ended March 31st, 1923, states that the total income of the municipal tramways was £270,241. The working expenses amounted to £178,242, leaving a gross profit of £91,999. In the previous year the revenue was £261,980, the expenditure £204,882, and the gross profit £57,098. After charging against this sum interest, sinking fund, and a deficit of £393 from the omnibus undertaking, and adding bank interest, there was a net profit of £34,381, as compared with £6,133 in the previous year. The number of passengers carried increased from

31,986,171 to 34,824,693, and the number of car miles run from 2,254,520 to 2,465,440. A sum of £42,677 was spent on capital account during the year. Permanent-way reconstruction accounted for £36,036 of this.

Burnley.—Accident.—A tramcar proceeding up the incline at Lane Head, on December 21st, got out of control. Running downhill, it left the metals, crashed into a house and shop on the bend, and was smashed to pieces. The driver and a pedestrian were killed, and the conductor and a number of the passengers were seriously injured.

Continental.—Esthonia.—The Council of the Railway Administration has sanctioned the scheme for the electrification of the line between Reval and Nomme. The estimated cost is 34 million Esthonian marks.

Czecho-Slovakia.—The electrification of the railway system will shortly be commenced, and the Prague-Kladno line will be the first to be electrified. Other lines to be converted to electric traction are the Prague-Zdice-Pizen and Prague-Kolin-Pardubice.

Irish Free State.—Co. Wicklow.—The County Council has passed a resolution asking the Dublin County Council, in the event of its being decided to continue the Dublin-Blessington tramway service, to accept responsibility for three-fourths of the charge of upkeep, in view of the fact that only 4¼ miles of the line runs through Wicklow and 10¼ miles through Dublin. The estimated cost of renewing the track is £8,000.

London.—Change-giving Machines.—To accelerate the booking of passengers on the Underground Railways, change-giving machines have been installed at Liverpool Street, Earl's Court, Brent, Hendon, Victoria, and Paddington. Recent tests have shown that the whole operation of supplying a passenger with ticket and change occupies only four seconds, and that 900 passengers can be booked by each machine in an hour, as against 660 with the old system.

L.C.C. Tramways.—The Highways Committee of the London County Council recommends the reconstruction of the Elephant and Castle sub-station at an estimated cost of £46,500. This is the largest and most important sub-station in the L.C.C. tramway system. Owing to a number of recent breakdowns both in the rotary converters and transformers, it can no longer be considered reliable. It is proposed to install modern plant and transfer the three present rotary converters to other sub-stations in substitution for older motor-generator plant, the last being held in reserve for service in the event of a breakdown.

New Zealand.—Auckland.—The City Council is to carry out extensions to the tramway system at a cost of £280,000. The work will extend over a period of three years.

South Shields.—Car Shed Extensions.—With a view to providing work for the unemployed, the Town Council proposes to extend the tramway car sheds at a cost of £21,000, and application is to be made to the Ministry of Transport for sanction to carry out the scheme. Application is also being made to the Unemployment Grants Committee for a grant towards the costs.

Walsall.—Proposed Railless Cars.—The Tramways Committee has instructed the manager to prepare a report on the possibility of introducing railless cars, and has postponed for one year the proposed renewal of the tramway track at Bloxwich.

TELEGRAPH & TELEPHONE NOTES.

Belgium.—New Radio Station.—The King of the Belgians laid the foundation of the new inter-continental radio transmitting station at Ruysselede in West Flanders on December 19th. The station is to be provided with three 250-kilowatt aerials, which can either be used alone or in parallel pairs, in the latter case giving a power of 500 kilowatts. It will be possible to transmit messages on a wave-length of from 16,000 to 25,000 metres at high speed (100 words per minute). Messages for transmission will be handed in at a distant office, probably in Brussels, connected with it by telegraph. This office will also deal with receiving; the receiving station will be set up in the neighbourhood of Brussels, and will likewise be connected by wire with the central office. It is expected that the new transmitting station will be ready for service towards the end of 1924 or the beginning of 1925.—*Reuter* (Brussels).

France.—Photo-Telegraphy.—According to *The Times* a number of offices will be opened experimentally in Paris on and after January 1st for the transmission of photo-telegraphic messages (by the system invented by M. Edouard Bélin) to Lyons and Strasburg. By this service exact reproductions of the originals will be delivered to the persons to whom they are addressed. The cost of photo-telegrams will vary from 2s. 6d. to 5s., according to the dimensions of the document or picture to be transmitted, which must not exceed 5.3 in. by 3.75 in. Additional offices will be opened in Paris on January 16th.

The Telephone Service.—New Edinburgh Exchanges.—Three new telephone exchanges are to be erected in Edinburgh, and at a Dean of Guild Court last week warrant was granted for a new building in Newington to be used as an exchange. The whole scheme, apart from plant, will cost £20,000. The automatic system is to be introduced, and when completed this automatic exchange will be the largest in the country.

RADIO NOTES.

Radio-Broadcasting. — Afternoon Transmission.—Beginning with the New Year, 2 LO, the London station, will fall into line with the other broadcasting stations in that it will transmit an afternoon programme instead of a morning one as at present.

France.—Broadcasting Parliamentary Debates.—A private Bill tabled by M. Lafagette, deputy for the Ariege Department, contains the proposal that, as the sittings of the Chamber ought to be public, present methods of publicity should be increased by the use of radio-telephony, the whole of the proceedings being broadcast. He adds that this should put an end to private conversations in the Chamber and to lack of attention, and should also have a restraining influence when deputies are tempted to allow the discussions to degenerate into noisy recriminations.—*Reuter* (Paris).

Irish Free State.—Radio-Broadcasting.—The Free State Parliament has remitted to a committee the question of control of radio affairs in the State. Considerable criticism has been directed against the scheme of the Postmaster-General (Mr. J. J. Walsh) giving power to an Irish broadcasting company to control the industries involved, the argument being that this would restrict trade, and that the issuing of licences, &c., should be exercised with a view to the encouragement of importers of parts, since they cannot at present be obtained in Ireland—or, at any rate, in the Free State—and must be brought from Great Britain or other countries.

In Dail Eireann last week the following motion by Mr. Darrel Figgis, was accepted: "That a committee of this Dail be appointed to consider the circular addressed to deputies, entitled 'Wireless Broadcasting,' especially with regard to the proposal by which it is intended that the State should pass over the right to licence and tax incoming radio apparatus to a clearing house under the control of a private company." In accepting it the Postmaster-General (Mr. J. J. Walsh) welcomed the appointment of a committee. His only desire was that there should be no delay, for, notwithstanding their efforts, broadcasting sets were being brought into Ireland without the possibility of detecting them. The proposed committee will consist of nine members, to report to Dail Eireann before January 16th, 1924.

Radio-Telephone Experiments.—"Amateurs'" Co-operation Invited.—The Metropolitan-Vickers Electrical Co., Ltd., has for some time been experimenting with a view to ascertaining the best methods of broadcast reception over long distances, and, with this end in view, has arranged with the Westinghouse Electric and Manufacturing Co., of Pittsburgh, U.S.A., to conduct a series of experiments extending over the first week of the new year. Arrangements are being made to gauge the possibility of receiving signals with sufficient clearness and separation from interference by atmospherics or other outside influences to enable them to be relayed to a broadcasting station and re-radiated. The Metropolitan-Vickers Co. will use a transmitting power of 1½ kW on 400 metres, with the call sign "2 AC," and transmission will be carried out with the special experimental plant in the research laboratories at Trafford Park. The Westinghouse Co.'s broadcasting station at Pittsburgh, known as "KDKA," was opened in December, 1920, and was the first to transmit a regular broadcast service.

While the station at Manchester will re-transmit the received messages at 400 metres, the actual transmission from Pittsburgh to Manchester will be carried out on a new system which this series of experiments is intended to test. It is specially requested that between the hours given below amateurs in this country will avoid oscillation, and listen rather to the re-transmitted messages with a view to reporting the success of the experiment. The first attempt will be made on New Year's Eve and, if reception is successful, re-transmission will probably commence shortly after midnight; in any case, as soon as possible after the British Broadcasting Co.'s stations have closed down; duing the remainder of the week it is hoped to radiate a message at 11.30 each night, British time. For the purpose of collecting experimental data, reports from those who are able to listen to the re-radiation (anyone who is able to pick up the Manchester B.B.C. station should be able to hear the re-transmission) should be addressed to Mr. A. P. M. Fleming, manager of Research and Educational Departments, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Argentina.—BUENOS AIRES.—January 21st. Department of Sanitary Works. Steam-driven electrical generating plant, for the waterworks at Posadas.*

March 21st. State Oilfields Administration. Construction of electric power station of 15,000 h.p. at Comodoro Rivadavia.*

Australia.—MELBOURNE.—February 11th. Electricity Commission. Four 100-kVA, 25,000-6,000-V transformers and spares. (December 21st.)

Aylesbury.—Electricity Department. One 30-ft. portable coal conveyor driven by a 220-V d.c. motor. (December 21st.)

Barking.—January 10th. County of London Electric Supply Co., Ltd. Complete lighting installation for the Barking power station and site. (December 21st.)

Belfast.—The Board of Guardians has extended the time for the proposals for central heating and lighting schemes until March 18th, 1924.

Belgium.—BRUSSELS.—The Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels, telephone lamps. Particulars (Cahier des Charges Special No. 761) for 1 fr. 70 c.

January 25th.—The municipal authorities of Romsée (Province of Liége. 385 electricity meters.

Tenders have this week been invited by the Belgian military authorities in Brussels for the supply of electric motors and a quantity of electrical material required in connection with the aerotechnical laboratory at Rhode-Saint-Genese.

January 15th.—Municipal authorities of Loupoigne (Province of Brabant). Establishment of a low-pressure electricity distribution system in the town. Particulars for 25 fr.

Bridlington.—January 14th. Electricity Department. One 30 ft. by 7 ft. 6in. Lancashire boiler. (See this issue.)

Canterbury.—January 14th. Electricity Department. L.p. lead-covered armoured feeder cable. (See this issue.)

Cardiff.—January 14th. Electricity Department. One 40,000-lb. water-tube boiler. (December 14th.)

Dublin.—January 1st. Port and Docks Committee. Two pairs of steel tramway type rail switches. Particulars from engineer's office, East Wall.

Egypt.—CAIRO.—January 21st. Ports and Lights Administration. Stores, including electrical goods, &c.*

March 1st.—The Director-General, Section of Municipalities and Local Commissions, Savoy House, Cairo. Supply and installation of a hydro-electric station, a transmission line and distributing poles in the town of Fayum.—*Reuter's Trade Service* (Cairo).

Gravesend.—December 31st. Town Council. Wiring houses, &c., under assisted wiring scheme. Borough electrical engineer, Suffolk Road.

Hastings.—January 21st. Electrical Department. Steel constructional work, coal bunkers and chutes, reinforced concrete pond and plant foundations. (See this issue.)

India.—INDIA STORE DEPARTMENT.—January 14th. Turbo-alternator set, condensing plant, cranes, boiler, economiser, pumps, steel chimney, pipework, switchboard, motor converter set, rotary converters, sub-station plant, e.h.p. feeder cables, and auxiliaries for new power station and sub-station at Delhi. (December 14th.)

Keighley.—January 14th. Electricity Department. Two 30,000-lb. water-tube boilers, stokers, economisers, bunkers, and fans. (See this issue.)

London.—FULHAM.—January 16th. Electricity Department. Two 6,000-kW. 3-phase turbo-alternators; three h.p. water-tube boilers, with economisers, stokers, soot blowers, &c. (See this issue.)

ISLINGTON.—January 30th. Electricity Department. Twelve months' supply of electrical and engineers' stores, including cables, meters, transformers, globes, lamps, electrical sundries, &c. (See this issue.)

Manchester.—January 8th. Electricity Committee. One 2,500-kW. motor-converter (lighting and power service), six 1,050/1,270-kW motor-converters (lighting, power, and traction services.) (December 21st.)

New Zealand.—WELLINGTON.—May 23rd (extended from April 30th). Public Works Tender Board. Arapuni electric power scheme (Section 2, power house and plant). Design, manufacture, supply, erection, testing, and maintenance for a period of six months of hydro-electric power station at Arapuni on the Waikato River, including machinery and plant, outdoor step-up transformer station, buildings, and all accessories.*

Rugby.—December 31st. Board of Guardians. Electric lighting installation for board-room and infirmary. J. W. Pendred, clerk.

South Africa.—JOHANNESBURG.—January 21st. Municipal Council. 240 tram poles, five miles of h.d. copper trolley wire.*

Spain.—MADRID.—February 6th. Supply of electric locomotives for the Ripoll-Ax-les-Thermes railway. Particulars from the Excmo. Señor Director de Obras Públicas, Ministerio de Fomento, Madrid.

Stoke-on-Trent.—January 16th. Electricity Department. One 50-ton electrically-driven overhead travelling crane. (December 21st.)

Ironclad l.p. switchgear. (See this issue.)

Wallasey.—January 18th. Electricity Department. 30 air-cooled transformers. (See this issue.)

York.—January 16th. Electricity Department. Two 25,000-lb. water-tube boilers, economisers, steam pipes, feed pumps, &c. (December 21st.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Government Contracts.—The following Government contracts were placed during the month of November:—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.

Electric travelling crane.—Babcock & Wilcox, Ltd.
Insulating fittings.—Micanite & Insulators, Ltd.
Generators, motors, and spares.—Small Electric Motors, Ltd.
100-kW motor-generator set, with switchgear, &c.—General Electric Co., Ltd.

ADMIRALTY, CIVIL ENGINEER-IN-CHIEF'S DEPARTMENT.

Electrically-driven winches.—Leeds Engineering and Hydraulic Co., Ltd.

WAR OFFICE.

Conduits and conduit fittings.—Barton & Sons, Ltd.
Electrolytic copper ingot.—British Metal Corporation, Ltd.
Copper sheets.—British Insulated & Helsby Cables, Ltd.
Electric light fittings (exterior).—Cable Accessories Co., Ltd.
Electric light fittings (interior).—General Electric Co., Ltd.
Electric meters.—Ferranti, Ltd.
Electric lighting installation at Maryhill Barracks.—Grindlay, Ross and Co., Ltd.

AIR MINISTRY.

Insulation tester.—Evershed & Vignoles, Ltd.
Magnetos.—British Thomson-Houston Co., Ltd.
Storage battery.—Premier Accumulator Co., Ltd.
Voltmeters.—E. Turner.
W.t. valves.—Mullard Radio Valve Co., Ltd.; General Electric Co., Ltd.

POST OFFICE.

Telegraph apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd. (Peel-Conner Telephone Works); International Electric Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Testing, protective apparatus, &c.—Evershed & Vignoles, Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; Siemens Bros. and Co., Ltd.
Telegraph and telephone cable.—Callender's Cable & Construction Co., Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.
Joint-box castings.—United Steel Companies, Ltd. (T. Butlin & Co. Branch).
Loading coils.—Western Electric Co., Ltd.
Conduit and fittings.—Barton & Sons, Ltd.; Eureka Conduit and Fittings Co.; General Electric Co., Ltd.
M.c. condensers.—British Insulated & Helsby Cables, Ltd.; Telegraph Condenser Co., Ltd.
Telephone cords.—British Insulated & Helsby Cables, Ltd.; Siemens Bros. and Co., Ltd.; Western Electric Co., Ltd.
Ducts.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.; Hepworth Iron Co., Ltd.; J. Oakes & Co., Ltd.; J. Place & Sons, Ltd.
Insulators.—T. De La Rue & Co., Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Earth plates.—Bullers, Ltd.
Telegraph poles.—Armstrong, Addison & Co.; Burt, Boulton & Haywood, Ltd.; Gabriel, Wade & English, Ltd.
Jointing sleeves.—Dugard Bros., Ltd.
Wood (creosoted) troughing.—Armstrong, Addison & Co.; Burt, Boulton and Haywood, Ltd.; Calders, Ltd.
Thermionic valves.—General Electric Co., Ltd.
Copper wire.—R. Johnson & Nephew, Ltd.; Pirelli-General Cable Works, Ltd.; J. Wilkes, Son & Mapplebeck, Ltd.
Enamelled copper wire.—London Electric Wire Co. & Smiths, Ltd.
E. and c. lapped wire.—International Electric Co., Ltd.
Flameproof wire.—Macintosh Cable Co., Ltd.
Steel wireless masts.—Rugby Imperial Wireless Station: Wrightson and Co., Ltd.
Submarine cables.—Turks Island-Barbados, Barbados-Trinidad, Barbados-Georgetown (British Guiana): Siemens Bros. & Co., Ltd.
Telephone exchange equipment.—Gloucester: Automatic Telephone Manufacturing Co., Ltd. (Sub-contractors for batteries: Chloride Electric Storage Co., Ltd.; for charging machine: Newton Bros. (Derby), Ltd.; for ringing machine: Crompton & Co., Ltd.; Ferranti Ltd.). Manchester: Automatic Telephone Manufacturing Co., Ltd. Gosport: Automatic Telephone Manufacturing Co., Ltd. Sub-contractors for batteries: Chloride Electrical Storage Co., Ltd.; for charging machine: Newton Bros. (Derby), Ltd.; Messrs. Scottish Oils, Ltd., Grangetown; Ward & Goldstone, Ltd.; Manchester: British Xylonite Co., Ltd.; Manningtree: Rowntree & Sons; Scarborough: Relay Automatic Telephone Co., Ltd. Hammersmith, W.: Western Electric Co., Ltd. Sub-contractors: Chloride Electrical Storage Co,. Ltd., for batteries. Edgbaston (Birmingham), Dudley: Western Electric Co., Ltd.
Telephone repeater station equipment.—Fenny Stratford: Western Electric Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Electric lighting Chester-le-Street housing scheme, Birtley and Pelton sites: Devereux, Moodie & Co.
Addjtions to generating plant.—S. Kensington, S.W.: Mather & Platt, Ltd.

CROWN AGENTS FOR THE COLONIES.

Insulated cable.—Callender's Cable and Construction Co., Ltd.
Electric light fittings.—Mather & Platt, Ltd.
Electrical materials.—General Electric Co., Ltd.
Train-lighting cells.—Pritchett & Gold and E. P. S. Co., Ltd.
Lux cells.—Chloride Electrical Storage Co., Ltd.
Telegraph material.—Bullers, Ltd.
Telephone cable.—W. T. Henley's Telegraph Works Co., Ltd.
Copper wire, &c.—J. Wilkes, Son & Mapplebeck, Ltd.
H.d. copper wire, &c.—Shropshire Iron Co., Ltd.

Leyton.—The Urban District Council is recommended to seal a contract with the Eastern Armature Winding Co., Ltd., for the electric lighting of Downsell Road School.

London.—HAMMERSMITH.—Electricity Committee.
Water-softening plant (£257).—W. Boby & Co., Ltd. (Recommended.)
Coal supplies.
100 tons Sherwood slacks at 15s. 9d. per ton on rail; 700 tons Exhall beans, 23s. 8d. per ton on rail.—Cleeves' Western Valleys Anthracite Collieries, Ltd. (Accepted.)

LONDON & NORTH-EASTERN RAILWAY CO. (GREAT CENTRAL SECTION).
Twelve months' supply of various accessories, of gasfilled lamps, and a portion of the company's requirements for metal filament train-lighting lamps.—Metropolitan-Vickers Electrical Co., Ltd.
The contract covers deliveries required at the stores at Gorton, Guide Bridge, Retford, Grimsby, Nottingham, Leicester, or London, as ordered.
Supply for 12 months, commencing January 1st, 1924, of enamelled iron shades and various items of Siemens gasfilled metal-filament electric lamps.—Siemens & English Electric Lamp Co., Ltd.

ROYAL MAIL STEAM PACKET CO. Accepted:—
Supply of metal-filament electric lamps for 12 months, commencing January 1st, 1924.—Siemens & English Electric Lamp Co., Ltd.

Maidenhead.—Board of Guardians. Accepted:—
Installing electric light in the sick wards and church (£114).—S. Evans and Sons.
This was the lowest local tender, and the lowest outside tender was £108.

Richmond-on-Thames.—Town Council. Accepted:—
New battery for an electric dust van (£206).—General Vehicle Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Six double-deck top-covered tramcars, complete with "Burnley" type trucks (£11,850).—English Electric Co., Ltd.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—CHRISTMAS LECTURES.—"Concerning the Nature of Things," by Sir William Bragg, F.R.S. At 21, Albemarle Street. At 3 p.m.
Saturday, December 29th. Lecture II. "The Nature of Gases."
Tuesday, January 1st. Lecture III. "The Nature of Liquids."
Thursday, January 3rd. Lecture IV. "The Nature of Crystals—Diamonds."

Physical Society of London and the Optical Society.—Wednesday and Thursday, January 2nd and 3rd. At the Imperial College of Science, South Kensington, S.W. From 3 to 6 p.m. and 7 to 10 p.m. Annual exhibition.

Institution of Electrical Engineers.—Thursday, January 3rd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Lecture on "Railway Electrification in Foreign Countries," by Dr. S. P. Smith.
(Wireless Section).—Wednesday, January 2nd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Some Experiments on the Screening of Radio Receiving Apparatus," by Mr. R. H. Barfield.

Junior Institution of Engineers.—Friday, January 4th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Economy of Fuel by Removal of Soot from Boiler Tubes," by Mr. L. Manico.

"Model Engineer" Exhibition.—Friday, January 4th to Friday, January 11th. At the Royal Horticultural Hall, Vincent Square, S.W.1.

NOTES.

E.T.B.I. Ball.—On December 14th the fifth annual ball of the Electrical Trades Benevolent Institution was held at Newcastle. The Heaton Assembly Rooms were tastefully and elaborately decorated for the occasion, electric lighting playing a large part in the scheme. A goodly sum was raised in aid of the funds by the sale of articles from a Christmas tree; the tree itself was also sold. Mr. Harry Tuff's orchestra provided the music for about 300 dancers. The arrangements were carried out by Capt. Kingsley Wardroper. The guests were received by Mr. R. Robson, chairman of the Local Advisory Committee, and Mrs. Robson; the principal guest was Sir Philip Nash.

The Women's Engineering Society.—It will be recalled that the Women's Engineering Society (incorporated 1920) held an international conference in Birmingham some time ago. It is now announced that a second international conference is to be held next Easter at Manchester. The Institutions of Automobile, Electrical, and Mechanical Engineers are all represented on the Council of the Society, which now has some 200 full members, *i.e.*, women who have definite engineering qualifications; there are two other classes of membership.

The British Electrical and Allied Industries Research Association.—It is intended to make the annual general meeting of this Association on January 11th, 1924, a public function. A lunch will be given at the Connaught Rooms, at which many scientific men co-operating in the work of the Association, and other eminent scientific men and engineers, are expected to be present. The president-elect, Sir Richard Glazebrook, will give an address.

Local Societies.—ELECTRICITY IN MINES.—At the annual dinner of the West of Scotland and Ayrshire branches of the Association of Mining Electrical Engineers, Mr. J. Masterton, Chief Inspector of Mines for Scotland, spoke of the development in the use of electricity in mines. He said that, while the plant generally was good, his only complaint was that in some cases it did not get a chance. They found at Redding that without electricity the five men who were got out alive could not have been rescued. It was the flexibility and adaptability of the electrical equipment that were the means of rescuing the men, and he believed most of the electricians taking part in that work were members of the Association of Mining Electrical Engineers.

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.—At the annual meeting of the Birmingham and District Electric Club, on December 20th, Mr. W. Shaw was elected president, Mr. D. G. Brooks treasurer, and Mr. T. H. Varco secretary. During the past year 14 new members were elected, making the present membership 171.

Appointments Vacant.—Plumber-jointer (temporary) for the Stoke Newington Borough Council Electricity Department; distributing engineer for the Croydon Corporation Electricity Department. (See our advertisement pages to-day.)

INSTITUTION NOTES.

Institution of Electrical Engineers.—INFORMAL MEETING.—At the meeting of the Informal Section on December 17th Mr. P. Dunsheath was in the chair, when Mr. G. R. A. Murray opened a discussion on students in electricity undertakings. He was of the opinion that electricity works gave very limited scope to the student, and Captain J. M. Donaldson endorsed many of the opener's views, and pointed out that the number of posts of chief engineer, or even station superintendent, was very limited, while the job of shift engineer was mainly a dead end, and should not attract the enterprising type of student whom the opener was mostly concerned about. The seniors did not want inventiveness or enterprise so much as efficiency from the young men, and any junior of spirit should try and get outside experience, even if it meant giving up a more lucrative post as shift engineer. Some years ago he spent two years or so in the U.S.A. and Canada, but he did not find the ex-University men he had as colleagues as soundly grounded as the students turned out by English colleges.

Mr. A. F. Harmer compared the prospects offered by engineering works and electricity supply undertakings, and expressed his pleasure at the decay of the premium-pupil system.

Mr. E. F. Hetherington stated that a young man should not go into a power station unless he was fitted for it and was prepared to stay in it. If he felt unfitted he should get into the sales or distribution side as soon as he could.

Mr. P. Dunsheath reminded the meeting that the electricity supply stations were far from standardised, and many problems required close study.

Messrs. F. Pooley, G. W. Preston, W. E. Rogers, and J. W. Thomas also spoke.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Prof. M. CHATELAIN, the president of the Central Electrotechnical Council in Russia, president of the Russian I.E.C. Committee, and president of the recently formed Russian Engineering Standards Committee, has spent a few days in London meeting influential people in the electrical world, and before his departure for Petrograd he was entertained at lunch at the R.A.C. by the B.E.S.A.

Shoreditch Borough Council Lighting Committee has re-elected Alderman P. KELLEHER chairman, and Councillor W. D. ELLIS vice-chairman for the ensuing year.

Hammersmith Borough Council Electricity Committee has appointed Councillor G. T. H. STAMPER chairman, and Councillor R. W. TWITCHETT vice-chairman for the current municipal year.

Stoke Newington Borough Council Electric Lighting Committee has appointed Councillor J. SPETCH KILSON chairman, and Councillor J. LITTEN vice-chairman for the ensuing year.

Councillor H. K. BEALE has been elected chairman of the Birmingham Corporation Electric Supply Committee.

On December 18th, at Stuart Street generating station, Mr. S. L. Pearce, C.B.E., chief engineer and manager of the Manchester Electricity Department, presented Mr. JAMES GASKELL, late engine-room foreman, with a wallet containing Treasury notes. The presentation was made on behalf of the staff and employés as a mark of their respect and esteem for Mr. Gaskell, who is retiring after 30 years' service. Mr. Gaskell went to the Electricity Department when in its infancy. He started the first engine at the Dickinson Street station—a set of 200 h.p.—and was present at the opening of Bloom Street Station, Stuart Street Station, and the new super-station recently erected at Barton. Mr. Gaskell has had the unique experience of seeing the largest municipal electricity undertaking in the United Kingdom expand from one set of 200 h.p. to several sets of 40,000 h.p. each.

Mr. A. J. REDMAN has been appointed London branch manager for the Knowsley Electrical Co., Ltd., of Liverpool, and his address is 245, Winchester House, Old Broad Street, E.C.

Mr. A. W. A. CHIVERS (British Electrical Federation, Ltd.) has been elected president of the Diesel Engine Users' Asso-

ciation for the year commencing January 1st, 1924. With regard to the honorary secretaryship, arrangements have now been made to relieve Mr. PERCY STILL of some part of the duties to which he has attended during the last ten years by appointing as joint honorary secretary with him, Mr. GEOFFREY PORTER, A.M.I.C.E.

Mr. H. R. SUMMERS has vacated the secretaryship of the British Engineers' Association and is joining the Board of Research & Development, Ltd., whose offices are at present at 25, Bedford Street, Strand, but will shortly be moved to larger premises to accommodate several of its subsidiary companies.

NEW COMPANIES REGISTERED.

Metal Treatment Co., Ltd. (194,397).—Private company. Registered December 13th. Capital, £2,000 in £1 shares. To carry on the business of electro-chemists and metallurgists, founders, electrical and mechanical engineers, metal workers, welders, descalers, cleaners, oxidisers, and platers of metals and metallic substances, &c. The subscribers (each with one share) are:—J. W. Nowell, 12, John Street, Bedford Row, W.C.1, clerk; W. A. Smith, 12, John Street, Bedford Row, W.C.1, clerk. W. A. Smith signs as director. Registered office: Fitzalan House, Arundel Street, Strand, W.C.

Radio Corporation (Scotland), Ltd. (12,936).—Private company. Registered in Edinburgh December 13th. Capital, £1,000 in 750 preference shares of £1 and 1,000 ordinary shares of 5s. each. To carry on the business of dealers in, and manufacturers and hirers of all kinds of wireless telegraphy and telephony, transmitting and receiving sets, components, &c. The subscribers (each with one preference share) are:—D. W. Fairweather, 47, Beechgrove Terrace, Aberdeen, merchant; J. M. Bruce, 44, Dunchattan Street, Glasgow, merchant. The first directors are not named. Qualification, £5. Remuneration £50 per annum for chairman and £40 per annum for others. Secretary: D. T. Greig. Registered office: 68, Irandon Street, Motherwell.

County Wireless Services, Ltd. (194,414).—Registered as a private company on December 14th, with a nominal capital of £500 in £1 shares (400 10 per cent. cumulative preference and 100 ordinary). The preference shares are entitled to an additional 20 per cent. of the surplus profits in any year after providing for a dividend of 500 per cent. on the ordinary shares. The objects are:—To take over the business carried on by Wireless Service, Ltd., in Tunbridge Wells, and in Kent, in Sussex, east of the Brighton Road, and in the eastern part of Surrey. The subscribers (each with one share) are:—N. V. Snell, 29, Court Road, Tunbridge Wells, solicitor; H. J. Snell, Howrah House, Tunbridge Wells, clerk. The first directors are not named. Secretary: H. J. Snell. The registered office is at 2, Calverley Parade, Tunbridge Wells.

Art Lights, Ltd. (194,465).—Private company. Registered December 17th. Capital, £5,000 in £1 shares (3,000 ordinary and 2,000 10 per cent. cumulative preference). To acquire the business of a manufacturer and factor of translucent plaster work of all kinds and general electrical engineer carried on by C. G. Smith at Cheltenham, together with patent No. 139,100 of 1920, and all or any of the assets of the business, and to carry on the same and the business of manufacturers of and dealers in electric light distribution devices, &c. The first directors are:—C. G. Smith, "Woodville," Oakland Avenue, Cheltenham, electrical engineer; J. W. Hinks, 115, Colmore Row, Birmingham, C.A.; T. H. Bond, "Osmotherley," Blackwell, Worcs., manufacturer. Registered office: 115, Colmore Row, Birmingham.

Rectoscope, Ltd. (194,402).—Private company. Registered December 13th. Capital, £100 in 1s. shares. To carry on the business of machinery, tool and plant merchants and agents, electrical, mechanical, kinematograph manufacturers, producers and photographic engineers, &c. The first directors are:—S. W. Pearson, "Vista," Wykeham Avenue, Hornchurch, Essex, brush manufacturer; R. F. Tunmer, 91, Osborne Road, Romford, inventor; A. S. Cubit, no address given; K. E. Bartlett, no address given. Qualification, 5 shares. Solicitor: E. E. Bale, 83, Cannon Street, E.C.

Vickers and International Combustion Engineering, Ltd. (194,387).—Registered on December 12th as a private company, with a nominal capital of £500,000 in £1 shares (300,000 "A" and 200,000 "B"). The "A" shares confer the right (a) to one vote per share, (b) to participate in all dividends and bonuses, and (c) to participate rateably with the holders of the "B" shares in the surplus assets in a winding up. The "B" shares confer the right to participate rateably with the "A" shares in the surplus assets in a winding up, but not to participate in dividends or bonuses. No share of any class other than the "A" shares shall confer any right to receive notices of or to attend or vote at general meetings. The objects are: To carry on the business of designers, manufacturers and builders of and contractors and constructional engineers for power plants of every description, including the equipment and maintenance thereof with all necessary machinery and apparatus, mechanical, consulting, civil, constructional, agricultural, gas, petrol, electrical, light and power, hydraulic and general engineers, mill furnishers, manufacturers and repairers, agents and brokers for and dealers in boilers, economisers, stokers, combustion apparatus, furnaces, ovens, and all other fuel-burning and heating devices, forced draught appliances and machinery, tools and implements, founders, welders, blade and spring makers, manufacturers of and dealers in aeroplanes, airships, seaplanes and aircraft of all kinds, aeronautical and submersible machines, wireless telegraphy and telephony, turbines and other engines, generators, condensers and accessories, motors, converters, switchboards and other electrical plant, motor cars, vehicles, and boats; motor body builders, wood workers, timber merchants, crane, screw and nail makers, &c. The subscribers (each with one "A" share) are:—W. R. Wood, Aldwych House, Aldwych, W.C.2, engineer; H. R. H. Ward, Warfield, Radlett, Herts., engineer. The first directors are: Sir Trevor Dawson, Bt., G. R. T. Taylor, G. E. Learnard and W. R. Wood. No qualification required. Remuneration as fixed by the company. Solicitors: Maxwell, Scriven and Batley, 29, Great St. Helens, E.C. No notice of situation of registered office was filed at time of incorporation.

Submarine Signal Corporation (2,276F).—Particulars filed on December 10th, pursuant to Section 274 of the Companies (Consolidation) Act. The capital is 3,000,000 dollars in 30,000 shares of preferred stock of 100 dollars each and 60,000 shares of common stock without nominal or par value. The company was registered in Delaware, U.S.A., on April 13th, 1923, to manufacture and deal in instruments, devices and equipment of all kinds used in connection with transmitting or receiving messages, sounds, signals and electrical current and power and for detecting and recording the presence or proximity or approach of objects of all kinds, and for determining depths, elevations, and distances, &c. The British address is Friars House, New Broad Street, E.C., where C. P. Whitcombe is authorised to accept service of process and notices on behalf of the company. The directors are:—M. C. Brush, H. E. Rogers, S. Whitaker, and H. Lieber, of New York; G. Dexter, of Boston, Mass.; R. F. Herrick and E. P. Whitney, of Milton, Mass.; F. Jewett, of Brookline, Mass.; F. Parker, of Bedford, Mass.; J. F. Perkins, of Hyde Park, Mass.; J. W. Powell, of Quincey, Mass.; O. V. Schrenk, of Far Rockaway, N.Y.; P. Stockton, of Manchester, Mass.; L. K. Thurlow, Melrose, Mass.; and W. M. Hahnemann, of Neal Keil, Germany.

Portarlington Electricity Supply Co., Ltd.—Registered in Dublin December 12th as a public company. Capital, £3,000 in £1 shares. To acquire the business of an electric lighting and electricity supply company carried on by the Portarlington Electric Light and Power Co., Ltd., at Portarlington, and to carry on the business of electrical engineers, electricians, &c. The first directors are:—T. W. Rice, Medical Hall, Portarlington, surgeon; A. A. Odlum, "Kilnacourt," Portarlington, flour miller; G. R. Matthews, Main Street, Portarlington, merchant; A. O'Connor, The Square, Portarlington, hotel keeper; C. E. Gilpin, Main Street, Portarlington, draper; J. Maher, "Woodview," Portarlington, farmer; J. F. Cole, "Oldcourt," Portarlington, engineer; E. Cor, Main Street, Portarlington, general merchant. Secretary: J. F. Cole. Registered office: "Oldcourt," Portarlington.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Burton & Tweedy, Ltd.—Particulars filed of £1,000 debentures authorised November 23rd, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Alpha Electric and Oxy-Acetylene Welding Co., Ltd.—Debenture dated December 3rd, 1923, to secure £2,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.2.

R. Egerton-Green, Ltd.—Particulars filed of £250 debentures authorised December 6th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Oriental Telephone and Electric Co., Ltd.—Satisfaction to the extent of £3,000 on December 4th, 1923, of debenture stock secured by trust deed dated June 28th, 1905, and supplemental deed dated June 12th, 1907, securing £200,000.

East Anglian Electricity, Ltd.—Satisfaction in full on November 20th, 1923, of debentures and mortgage dated March 6th, and December 27th, 1900; November 15th, 1901; November 14th, 1908; December 14th, 1914; September 13th, 1917; January 4th, 1921; April 4th, 1923; and February 1st, 1921, securing £600, £500, £200, £50, £300, £2,000, £10,000, £1,000, and £1,000 respectively.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £6,200 on December 6th, 1923, of charges dated March 24th, 1911; November 13th, 1912; and March 11th, 1915, securing £250,000.

Torquay Tramways Co., Ltd.—Satisfaction to the extent of £1,200 on December 5th, 1923, of charge dated March 8th, 1911, securing £60,000.

CITY NOTES.

Edison Swan Electric Co., Ltd.

The annual meeting was held on December 18th, at the Cannon Street Hotel, E.C., Mr. C. F. Spencer in the chair. In moving the adoption of the report (see ELEC. REVIEW, December 14th, p. 906), the chairman, referring first to the accounts, said that the item of patents, goodwill, &c., remained at the same figure as in the last balance sheet. Investments showed a slight increase, but next year they would be substantially reduced, as it was intended to apply the £50,000 received from the sale of the shares in the Enfield Cable Works to the reduction of the bank loan. Stocks, including work in progress, stood at the figure of £334,065. In that business it was necessary to carry large stocks to meet the diversified demands due to the different systems of supply of electrical energy in this country, and the wireless branch of the business, which they were conducting with success, had increased both the classes and quantity of stocks. They had endeavoured to value the stocks on a very conservative basis, having due regard to the character of the stock and the susceptibility of some part of it to change in fashion. 35 per cent. of the total stock represented work in progress and raw materials for use in manufacture, the balance being finished units ready for sale. Sundry debtors, amounting to £200,894 and £5,221, had been debited to profit and loss account to increase the reserve for doubtful debts and discounts, the total of the reserve being more than adequate to meet normal requirements. On the liability side of the balance sheet the share capital appeared on the basis approved at the last meeting of the shareholders. The first and second debenture stocks amounted on June 30th last to £330,219, and the accrued interest thereon was £5,502, whilst the sum then standing to the credit of debenture stock sinking fund, awaiting utilisation in redemption of debenture debt, was £13,516. The item of loans, &c., £314,150, was the amount due to the bankers, but that had been reduced since June 30th, 1923, to £289,450, and would be further reduced by a repayment of £30,000 on December 31st, 1923, to £259,450. During the next half-year they hoped to make other substantial repayments, and he believed that when the next balance sheet was submitted it would exhibit a marked decrease in their debt obligation under that heading. Sundry creditors and credit balances were less by £14,447 than on June 30th, 1922, whilst bills payable, an item which was not likely to appear in the balance sheet again, figured at £7,647. The balance, subject to Corporation profits tax, was arrived at as stated in the profit and loss account, the items in this account being set out in a somewhat different manner. General expenses absorbed £17,394, whereas in the last accounts the

figure was nearly four times as much. The principal reason for that reduction was, apart from economies which had been effected, that the costs of advertising had been debited against trading before arriving at the trading profit of £148,033, as they considered that advertising was an essential and integral part of their trading cost. The directors were entitled to fees to the extent of £3,000 and bonus on profits, but they had only exercised the powers contained in the Articles to the extent of £2,500. He would like at that juncture, as chairman and managing director on whom the responsibility for initiating and carrying out the scheme of reorganisation of the company had fallen, to tender to his colleagues on the board his personal thanks for the work which they had so willingly and freely performed, often at great personal sacrifice, in the rearrangement of the company's affairs, and he could say that the change was a welcome one which had been carried through without much loss of time. Their thanks were due to the company's loyal and devoted staff, who had worked so assiduously to achieve some degree of success. The company had a staff which would do credit to any industrial organisation. Loan charges of £39,569 included £7,003, which was profit applied to sinking fund to be appropriated to redemption of debentures. The loan charges would diminish as they pursued their policy of debt repayments. The report set out fully the board's recommendation as to the disposal of the profit of £71,162, and it was anticipated that the balance to be carried forward to next year would, after payment of corporation profits tax, be in excess of £11,000. The policy of the board might be summed up quite shortly as follows: (1) Having carried through a scheme of reorganisation which had effected economies, speeded up and properly regulated output, increased sales and withal maintained the high quality of their products, they were now engaged in reviewing the whole position, so as to secure even greater efficiency in every section. (2) To discharge the temporary loan obligations of the company as rapidly as circumstances would permit. (3) To build up an adequate reserve fund, and if the shareholders adopted their recommendations, the first contribution to such a fund would have been made. With respect to current trading profits, their sales for the five months up to November 30th had increased appreciably over those of the corresponding period of last year, notwithstanding the average reduction —not less than 10 per cent.—in the selling prices of their products, and they had every reason to believe that their profit for the five months was as good, and perhaps a little better, than that which resulted from trading in the corresponding period of last year. He saw no reason why that progress should not be maintained if home demands continued in anything like the same volume as during the last 18 months, a period of undoubted trade depression. The orders which were being placed in this country to provide more employment should give an impetus to many trades for a limited time, consequently the business of the company in the immediate future was likely to benefit indirectly from the orders distributed amongst other trades. It was obvious that the Government and railway companies could not continue indefinitely providing work for the relief of unemployment, and when that class of work ceased the severe handicaps on home production would manifest themselves in a very prejudicial manner in many of this country's industries unless a settlement of the economic conflict in Europe was secured on a firm and equitable basis. Depreciated exchanges were, in effect, operating as a bounty to foreign manufacturers on exports to this country and our colonies; moreover, in those countries which were our allies during the war the comparative relief from the burden of unemployment, together with their freedom from payment of interest charges on loans advanced to them by this country—such interest charges falling on our tax-payers instead of theirs—gave producers in those countries a marked advantage over producers in this country when competing for trade in any market. In conclusion, he would like to say that the company was now well equipped to deal efficiently with every branch of its business, and he expressed the hope that it had now entered on a period of prosperity, and that the coming year would bring real peace in Europe, and with it contentment and prosperity to our countrymen.

Mr. A. F. Berry seconded the motion, which was carried unanimously without discussion.

Charing Cross, West End and City Electricity Supply Co., Ltd.

An extraordinary general meeting of the shareholders of this company was held on December 19th, to consider resolutions for dividing the £5 shares into five £1 shares, for converting the unissued preference shares into ordinary shares, and for making certain minor alterations in the Articles of Association.—Mr. W. F. Fladgate, M.V.O., who presided, proposed the first resolution as follows:—

"That as on and from the 29th day of February, 1924, each of the existing preference shares, ordinary shares, City Undertaking preference shares and City Undertaking ordinary shares of £5 each respectively in the capital of the company be sub-divided into five shares of £1 each respectively, credited as fully paid in the case of those shares already issued, and that each £1 preference share, £1 ordinary share, £1 City Undertaking preference share and £1 City Undertaking ordinary share respectively resulting from such sub-division shall have attached thereto respectively the same lights as regards dividend, return of capital, voting and otherwise as were attached to each £5 share of the same class prior to such sub-division."

He said the meeting had been convened with a view to complying with what was believed to be a general desire on the part of the shareholders, *viz.*, that the whole of the shares of the company which had hitherto been of the denomination of £5 each, should be subdivided into shares of £1 each, the right as regarded dividends, return of capital, voting and otherwise, being in no way interfered with or altered. The directors had no desire whatever to press the resolution, but he believed there was a preponderance of desire on the part of the shareholders for the proposed subdivision of the shares. Mr. J. M. Gatti seconded the resolution, which was carried unanimously. The chairman then moved:—

"That the unissued preference shares of the company be and they are hereby converted into ordinary shares, and that the directors be authorised accordingly to issue the same as ordinary shares ranking *pari passu* in all respects with the existing ordinary shares of the company."

He said the reason for wishing to convert the unissued preference shares into ordinary shares was that circumstances had so altered since the shares were originally created as to make them to-day unissuable. It was well known that shares could not be issued at a discount, and there seemed no prospect of disposing of 4½ per cent. preference shares at par. Consequently, it seemed to the directors to be obviously in the interests of the company that the unissued capital should be put in such a form as to render it available for issue to the public should the necessity arise. Mr. Gatti formally seconded the resolution, and it was carried. A number of minor alterations in the Articles of Association were agreed to, including one changing the name of the company to "The Charing Cross Electricity Supply Co., Ltd.," the chairman pointing out that that was the name under which the company was at present generally known.

British Columbia Electric Railway Co., Ltd.

In their report for the year ended June 30th, 1923, which is to be presented at the annual meeting to-day (December 28th), the directors state that the net revenue for the year, after deducting corporation profits tax, and providing for depreciation, sinking fund, and renewals, was £416,472. Adding the sum of £26,272 brought forward from the last account, gives a total of £442,744. Against this has been charged debenture and debenture stock interest, £132,015; dividend on 5 per cent. cumulative perpetual preference stock, £72,000; interim dividend at the rate of 3½ per cent., free of tax, on the preferred ordinary stock, £67,128; and a similar dividend on the deferred ordinary stock, £67,128. Out of the balance of £104,473 it is proposed to pay a final dividend at the rate of 18s. 8d. per cent., free of tax, on the preferred ordinary stock (making £4 16s. 2d. for the year), £16,168; to pay a final dividend at the rate of £2 11s. 11d. per cent., free of tax, on the deferred ordinary stock (making £6 9s. 5d. for the year), £44,968; and to carry forward the balance of £43,337.

The number of passengers carried fell from 69,314,667 to 67,692,851, but the increase in revenue from other sources more than compensated for the decline. The carriage of freight increased from 321,081 tons to 377,822 tons. Both the freight and power departments benefited by increased activity in the lumber business, and the sales of gas and electrical appliances were satisfactory.

The total power sold during the year was 192,453,979 kWh, as against 177,256,106 kWh in 1921-22, and there were proportionate increases in the number of consumers, and in the connected load. The increase in the number of consumers counterbalanced a decrease in the lighting rate in Vancouver from 6 cents to 5 cents per kWh on January 1st, 1923. The demand for gas also continued to increase.

On May 3rd, 1923, the company entered into an agreement with the Corporation of the district of South Vancouver, permitting the continuance of the present fare (6 cents) for a period of three years, and providing for arbitration at the end of this time. One of the conditions of this arrangement was the reduction of the lighting rate in the district from 7 cents to 6 cents per kWh. Taxation continued to increase; the total for 1922-23 was $529,728, as against $493,694 in 1921-22. In addition to this, new taxes would, it was estimated, cost the company not less than $80,000 per year. The work of rising the height of the dam at Stave Lake was completed, and the fourth set of 7,500-kW capacity is now in operation. The raising of the dam, coupled with the plans under way for supplementing the waters of the Stave Lake with the waters of the Alouette Lake, will make possible the installation of a fifth set, capable of generating 18,000 kW. The plans include the driving of a tunnel 3,900 ft. in length through which the water from Alouette Lake will run down to the Stave Lake. The fall of the water at the end of the tunnel will, by the erection of a power house on the shore of the Stave Lake below the tunnel level, permit the development of an additional 10,000 h.p. At a point on the Stave River, four miles below the Lake, a further station with a capacity of 80,000 h.p. will eventually be erected, so that the company will be in a position to meet the demand for power for many years to come.

Mr. George Kidd has been elected to the board, and has been appointed president. Mr. Murrin has been appointed vice-president, and Mr. A. T. Goward vice-president in Victoria.

Burmah Electric Tramways and Lighting Co., Ltd.

The annual meeting was held on December 17th, Mr. C. O. Webb (chairman) presiding. In presenting the report and accounts, the chairman referred to the issue of 50,000 shares of £1 each in August last, 20,000 of which were given to preference shareholders, together with 11 per cent. in cash, in satisfaction of arrears of dividend. Reference was also made to the decision to convert the £5 shares to five shares of £1 each. The working profit for the year was £21,866, as compared with £16,546 in the previous year. The increase was chiefly due to increased sales of energy and reduced upkeep costs of the power plant. Interest on investments and the balance brought forward made a total of £23,946 available. It was proposed to distribute this as follows: Depreciation fund, £7,500; expenses of issue of new preference shares, £645; employés' gratuity fund, £500; loss on exchange, £203; dividend on £100,000 preference capital at 11 per cent., £11,000; balance carried forward, £4,098.

The report and accounts were approved and adopted.

Southern Canada Power Co.

The directors' report for the year ended September 30th, states that the growing local interest in the securities of the company was substantially increased by a customer ownership campaign which opened on October 27th, 1923, when 2,000 shares of preferred stock were offered the customers of the company. Employés are also taking an increasing interest in the company's securities. The output for the year shows an increase of 12½ per cent. over that for the preceding year, and sales of merchandise, while slightly lower, were recovering rapidly towards the end of the year. Consolidated annual statement shows that the gross earnings were $953,970, and expenses $422,741. Profit and loss account shows balance brought forward, $58,512; add earnings for year, $253,055; less dividends on preferred stock, $82,161; and depreciation reserve, $102,000; leaving $127,406 to carry forward.—*Financier.*

Northampton Electric Light and Power Co., Ltd.

A meeting of the holders of the 4 per cent. debenture stock is to be held tomorrow (December 29th), when a proposal to convert the stock into new stock bearing interest at 5 per cent. will be submitted for approval. A cash bonus of £2 per cent. will be paid upon the conversion. If the proposal is approved the holders of the 7 per cent. second debenture stock will be notified of the company's intention to pay them off on July 1st, 1924, and an opportunity will be given to them to convert their holdings into the new 5 per cent. stock.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

English Electric Co.—£1,303,192 6 per cent. convertible debenture stock.
Kalgoorlie Electric Power and Lighting Corporation.—£128,318 6 per cent. income debenture stock, in lieu of the preference shares now quoted.

Application has been made to the Committee to allow the following to be officially quoted:—

Electric Supply Corporation.—150,000 ordinary shares of £1 each, fully paid, Nos. 1 to 150,000; and 150,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 150,000.

Claud Hamilton, Ltd.—According to the *Financial Times*, a dividend of 2½ per cent. for the past year is recommended; £5,000 to general reserve, and £8,342 carried forward; £10,000 to be transferred from general reserve and applied to writing down goodwill.

Edmundson's Electricity Corporation, Ltd.—Dividend at the rate of 6½ per cent. per annum, less tax at 4s. 6d., on ordinary shares.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., equal to 1s. per share, less income tax. A similar dividend was paid in January last.

STOCKS AND SHARES.

Friday, December 21st, 1923.

With the Electrical Review going to press earlier than usual by reason of the Christmas holidays, it is impossible to get prices up to a day as late as usual, and those included in the following tables compare with last Monday's Stock Exchange quotations. Some protest has recently been raised in connection with these prices, it being argued that they do not represent the actual market conditions ruling at the time they are supposed to be made up to. This is, unfortunately, justifiable criticism, and the fact that it has been levelled so often on previous occasions renders it none the less regrettable that the Stock Exchange Committee does not take steps to see that prices, published under its own ægis, are as accurate and reliable as is possible in the circumstances.

If a broker can deal in electricity supply shares on the basis of a margin of 5s. or 3s. 9d., between selling and buying prices, it is difficult to pardon the Stock Exchange Official List for sending out a margin of 10s. between the two figures. Some time ago the Stock Exchange Committee, in response to protests raised here and elsewhere, gallantly endeavoured to get the matter remedied. For some little while a more reasonable set of prices was published, but it was not long before the jobbers drifted back to their previous practice of providing prices that are indefensibly wide, considering the actual quotations that prevail in dealing.

Lines of stock have been thrown upon the markets during the past few business days. On Monday and Tuesday in this week, the selling was very pronounced on behalf of the public. People are becoming thoroughly alarmed at the prospect of a Capital Levy and Nationalisation. Stocks are being pitched overboard indiscriminately, and, although feeble rallies take place every now and then, there is no real power of resistance such as would be furnished, in the ordinary way, by investors who are alive to the opportunities presented to them for picking up cheap stock. The outlook is so unique that experience has nothing to offer in the shape of what has happened in the past in like circumstances. Metropolitans and Districts are lower, though Undergrounds keep tolerably steady. Steam stocks are weak as a whole, and the heaviness of War Loan, with other British Government securities, acts as a pall upon prices of investment stocks of every description.

Depression has begun to creep into the list for electricity supply shares. Nationalisation, it is held, is not likely to stop at railways in its application. Any utility branch of industry may be brought within its purview, and fears of this occurring are responsible for declines in City of London, County of London, Charing Cross and several others. The falls are trifling as compared with the previous rises which have taken place during the current year, but they serve to illustrate the tendency of the moment. Holders of South Metropolitan Electricity shares should take up the new issue that gives them so handsome a turn.

Moreover, the very people who were eager to buy electricity supply shares only a month ago are now holding back, preferring to wait and see what is likely to happen when Parliament re-assembles three weeks hence. Eastern Telegraph ordinary gave way to 16¼, and the rest of the cable group has been dull in sympathy. Marconis dipped to 39s., and Canadian Marconis to 5s. 3d. There was no particular recovery, either, from the worst, though on a little bear covering, Marconis rallied to £2, leaving them unchanged on the week.

Babcock & Wilcox have been down to 41s. 3d., at which level some of their usual supporters in the country came forward to pick up the shares, with the result that the price hardened to 42s. 6d. At this they may be regarded as a sound investment of their class, giving a reasonable return on the money. Siemens are also easier. Edison & Swans remain dull at 4s. 6d., unaffected by the chairman's speech at the meeting on Tuesday, at which he referred at length to the outlook for his own company and to the electrical manufacturing business at large.

Mexican bonds and shares have experienced no recovery, and the foreign list as a whole is inclined to heaviness. The British Columbia Electric Railway has increased its preferred and deferred stock dividends. A fair amount of business is being done in Calcutta Tramways ordinary at the slightly lower price of £1. The company's 5 per cent. preference are quoted at 16s. middle, and the 7 per cent. second debentures at 100¼. Cape Tramways changed hands the other day at 18s. and 18s. 7½d. Hong-Kong Tramways, which rarely encounter any business, found a purchaser at 15s. 6d., and the gambling counter, La Plata Electric Tramways ordinary shares, were done at 1s. last week. Lisbon Electric Tramways ordinary, which have received no dividend for nearly eight years, have been negotiated on the basis of 1s. 6d., and Para Electric Railways ordinary shares met with occasional buyers at 1s., the company's first and second preference, neither of which has received any dividend since March, 1921, being quoted at half-a-crown.

The approaching visit to this country of Mr. Theodore, the Premier of Queensland, will be awaited with a good deal of interest by, amongst others, holders of Brisbane Electric Tramway shares, the nominal price of which is 3½ for the £5 shares fully paid. The company's 8 per cent. first debenture stock is quoted at 98 middle.

Rubber shares mope in neglect; prices are easier on the week. Iron, steel and kindred shares, after an acute attack of depression, rallied noticeably from the lowest prices touched.

SHARE LIST OF ELECTRICAL COMPANIES.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Dec. 21, 1923.	Rise or fall.	Yield p.c.
Home Electricity Companies.	£					
Brompton Ordinary	1	12	12	2⅛	—	£5 16 3
Charing Cross Ordinary	5	9	14	14	− ½	5 0 0
do. do. do. 4½ Pref.	5	4½	4½	4⅞	—	5 4 4
Chelsea	1	6	10	37/-	—	5 11 1
City of London	1	14	15	2⅝	− ⅛	6 9 10
do. do. 6 % Pref.	1	6	6	24/-	—	5 4 4
County of London	1	8	10	39/6	−1/9	5 1 3
do. do. 6 % Pref.	1	6	6	23/-	−3d.	5 4 4
Edmundson's Ordinary	3	Nil	7	4	—	5 6 1
do. 6 % Pref	5	12/-	6	5½	—	5 14 3
Kensington Ordinary	5	10	12	10⅜	+ ⅛	5 15 8
London Electric	3	4	10	4½	− ⅛	6 6 0
do. do. 6 % Pref.	5	6	6	5⅛	—	5 9 1
Metropolitan	1	7	8½	34/-	—	5 0 0
do. 4½ % Pref.	1	4½	4½	17/6	—	5 2 10
Newcastle-on-Tyne Ordinary	1	Nil	2½	15/6	—	3 4 6
do. 5 % Pref.	1	5	5	15/9	—	6 7 0
do. 7 % Pref.	1	7	7	23/-	—	6 1 9
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref.	1	6	6	23/-	—	5 4 4
Urban Ordinary	1	Nil	—	18/9	—	Nil
do. 6 % Pref.	1	2½	5	18/9	—	6 9 4
St. James' and Pall Mall	5	12	14½	11⅜	—	6 4 9
South London	1	7	10	1½	—	5 8 3
South Metropolitan Pref.	1	7	7	24/6	—	5 14 8
Westminster Ordinary	5	10	12	10⅞	+ ⅛	5 17 8
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	—	7 8 2
Home Rails.						
Central London Ord. Assented	Stock	4	4	73	—	5 9 7
Metropolitan	,,	2½	0⅝	70½	−1½	4 19 8
do. District	,,	1	3	54	—	5 11 1
Underground Electric Ordinary	10	Nil	Nil	2½	—	Nil
do. do. "A"	1	Nil	Nil	7/6	—	Nil
do. do. Income	Bonds	4	5	100	—	*6 0 0
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 15 11
do. Def.	,,	1½	84/6	29½	—	6 9 0
Chile Telephone	5	6	6	6	—	5 0 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	16⅞	—	19 3
Eastern Tel. Ord.	Stock	10	10	164	−3½	1 11
Globe Tel. and T. Ord.	10	10	10	17½	—	5 17
do. do. Pref.	10	6	6	11½xd	—	5 7 10
Great Northern Tel.	10	24	22	23½	—	7 16 0
Indo-European	25	10	7	32½	—	*5 7 8
Marconi	1	25	15	2xd	—	6 13 4
Oriental Telephone Ord.	1	12	12	1⅞	—	*6 8 0
United R. Plate Tel.	5	8	8	6⅝	—	*5 16 4
West India and Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16	—	*6 5 0
Home and Foreign Trams, &c.						
Anglo-Arg. Trams. First Pref.	5	5½	12½	8⅛	—	8 16 0
do. do. 2nd Pref.	5	Nil	5½	3	—	9 16 0
do. do. 5% Deb.	Stock	5	5	78	+2	6 8 2
British Electric Traction Ord.	,,	4½	5	68	−2	7 2 10
do. do. 6% Pref.	,,	6	6	98½	—	6 1 10
Brazil Traction	100	Nil	4	45	—	8 18 0
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	54½	—	5 18 4
do. do. Preferred	,,	5	96/-	85	+ ½	*5 13 8
do. do. Deferred	,,	3	127/-	98½	—	*6 8 6
do. do. Deb.	,,	4½	4½	77½	—	5 9 8
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	6/8	−6d.	15 7 8
London United Tram. Deb.	Stock	4	4	59	—	6 13 4
Mexico Trams. 5 % Bonds	—	Nil	Nil	60½	−3	7 4 0
do. 6 % Bonds	—	Nil	Nil	5⅛	—	Nil
Mexican Light Common	100	Nil	Nil	19	—	Nil
do. Pref.	100	Nil	Nil	47½	—	Nil
do. 1st Bonds	—	Nil	5	61½	—	8 2 8
Manufacturing Companies.						
Babcock & Wilcox	1	15	20	21	—	*4 14 1
British Aluminium Ord.	1	10	5	18/-	—	5 2 7
British Insulated Ord.	1	15	15	2⅛	—	6 0 0
Callenders	1	15	15	2⅛	—	6 1 2
do. 6½ Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Ord.	1	10	5	½	—	10 0 0
Edison-Swan	4/-	10	Nil	4/6	—	Nil
do. do. 5% Deb.	Stock	5	5	67½	—	7 8 2
Electric Construction	1	10	10	29/6	—	6 15 7
English Electric	1	8	6	17/6	−3d.	5 10 0
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	22/6xd	—	5 15 7
do. Ord.	1	10	5	19/9	—	5 1 3
Henley	1	15	15	49/3	—	6 3 0
do. 4½ Pref.	5	4½	4½	4½	—	5 9 10
India-Rubber	1	10	—	13/9	—	*7 8 4
Met.-Vickers Pref.	2	8	8	9⅞	—	6 11 0
Siemens Ord.	1	10	10	15/-	−2/-	Nil
Telegraph Con.	10	20	20	24	− ½	*6 0 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Dec. 24.	Fortnight's Inc. or dec.
a Acid, Oxalic per lb.	5½d.	...
a Ammoniac, Sal per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ,,	...	...
a Borax ,,	£25	...
a Copper Sulphate ,,	£25 10s.	...
a Potash, Chlorate per lb.	4d. to 4½d.	...
a ,, Perchlorate ,,	4½d.	...
a Shellac per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ,,	£7 15s.	...
a ,, Roll ,,	£7 15s.	...
a Soda, Chlorate per lb.	8d.	...
a ,, Crystals per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots per ton	£115 to £120	...
b ,, Wire per lb.	1/9 to 2/6*	...
b ,, Sheet ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£219	...
Grade II ,,	£156	...
Grade III ,,	£86	...
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c ,, Tubes (solid drawn) ,,	1/0 to 1/0½d.	...
c ,, Wire, basis ,,	10½d.	...
c Copper Tubes (solid drawn) ,,	1/1½d.	...
c ,, Bars (best selected) per ton	£95	...
c ,, Sheet ,,	£95	...
c ,, Rod ,,	£95	...
d ,, (Electrolytic) Bars ,,	£68 5s.	5/- inc.
d ,, ,, Sheets ,,	£145 10s.	...
d ,, ,, Wire Rods ,,	£78 5s.	5/- inc.
d ,, ,, H.C. Wire per lb.	9½d.	½d. inc.
f Ebonite Rod per lb.	8/6	...
f ,, Sheet ,,	2/-	...
n German Silver Wire ,,	2/3	...
h Gutta-percha, fine ,,	6/6	...
h India-rubber, Para fine ,,	1/0½	...
i Iron Pig (Cleveland Warrants) per ton	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ,,	£34 15s.	5/- inc.
g Mercury per bot.	£9 17s. 6d.	2/- to 2/6 inc.
e Mica (in original cases) small per lb.	3d. to 3/-	...
e ,, ,, medium	4/- to 8/-	...
e ,, ,, large ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/9	...
p ,, drawn bars and rods ,,	1/9½	...
p ,, rolled strip & sheet ,,	1/9½	...
p ,, wire ,,	1/9½	...
o Platinum per oz.	£35	...
d Silicium Bronze Wire per lb.	1/0½	...
r Steel, Magnet, in bars ,,	10d.	...
n Tin, Block (English) per ton	£235 10s. to £236	£2 10s. dec.
n ,, Wire, Nos. 1 to 16 per lb.	1/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Curie Pension.—The Bill granting a yearly pension of £500 to Mme. Curie for the part taken by her in the discovery by her husband, Prof. Curie, of radium, was passed by the French Chamber on December 19th, the 25th anniversary of the discovery of the element.

An instrument which counts atoms audibly was shown by Mms. Curie at the Physical Exhibition held recently in the Grand Palais, Paris. It announces by means of a loud-speaking telephone the actual disintegrations of a small piece of the rare element polonium, and for the first time in history people can thus listen to the transmutation of elements. A tiny silvered plate containing a minute amount of polonium is placed under a tube with its aperture at such a distance that about a dozen alpha particles pass through it each second. Polonium, like radium, is constantly breaking up into alpha particles of helium, which travel a distance of about 1½ in. It lasts as polonium only 202 days, whereas the life of radium before its disintegration is nearly 2,300 years. Each particle on penetrating the tube causes a luminous discharge which acts as a switch, throwing into circuit a minute electric current that actuates the loud speaker of an ordinary radio valve receiver. One thus hears the rapid tick-tick caused by the transmutation of polonium into helium. The instrument provides a novel method of counting the alpha particles emitted by radio-active bodies, and, devised as it is by one of the discoverers of radium, it is creating great interest.—*Daily Mail.*

Library Advertising.—The Public Libraries Committee of the St. Marylebone Borough Council has agreed to a small advertisement of the Electricity Department being issued as a bookmark.

A GENERAL FORMULA FOR CALCULATING THE TEMPERATURE OF ELECTRICALLY HEATED WIRES.

In the design of resistance and heating elements consisting of straight or coiled wires in air, the relation between current strength and wire temperature is a factor of primary importance. Uncertainty concerning the exact conditions to which the wire is subjected, and concerning the effects thereof, makes it difficult to arrive at accurate results by applying the laws of heating and cooling. Preliminary experiments must be made with each material, and most manufacturers of resistance wires issue tables showing the current required to bring the wires to particular temperatures under stated conditions; also the maximum permissible current for each wire.

In a recent issue of the *Bulletin* of the Swiss Electrotechnical Association, Prof. A. Imhof gives a formula which has a rational theoretical basis and has been verified by practical tests. This formula is supplemented by a useful table of constants for various resistance wires. The author finds that for constant temperature of the wire—

$I^2 \rho = K$ very nearly ... (1)

where I = the current, in amperes; ρ = resistance, in ohms, of a wire 1 metre long and 1 mm.^{2} in cross section; and K = a constant. This result is what would be expected, for the heat produced is Q = Constant $\times I^2R$. The cooling conditions are similar in all so-called resistance wires. Conduction from the interior to the exterior plays no great part; the surface is always smooth and, though the colour is, in some instances, silver-white when the wire is new, it gradually becomes black in service. Under conditions so closely similar, the same development of heat produces the same temperature. The specific resistance ρ varies differently with temperature in the different materials, but the variation is so small that the differences are not important.

The relation $I^2 \rho = K$ is verified by experimental data.

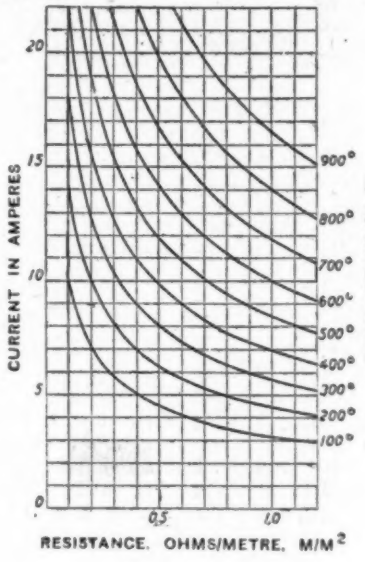


FIG. 1.

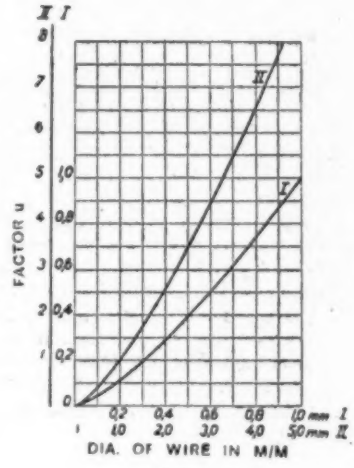


FIG. 2.

For a particular diameter of wire, the constant K depends solely upon the temperature t of the wire, according to the equation :—

$$K = 13{\cdot}31\, e^{0{\cdot}0046\, t} - (10{\cdot}46 - 0{\cdot}0208\, t) \quad \ldots \quad \ldots \quad (2)$$

Physical Constants of Resistance Materials.

Material.	Specific resistance in Ohms per metre, 1 mm.^{2} section.	Temperature coefficient of resistance per 1° C.	Maximum permissible temperature. °C.	Melting point. °C.	Sp. Gr.
Calido	1.03	0.00036	900	1530	8.15
Cekas	1.0 (±0.05)	{0.000525 (0—200°) 0.00017 (200—900°)}	900 (1100)	ca. 1450	8.25
Ardor	1.0 (±0.02)	0.00044	900 (1100)	ca. 1500	—
Rayo	0.95	0.00018	900 (1100)	1530	8.05
Chromium Nickel Steel ...	0.88	0.0011	500	1410	8.10
Comet	0.87	0.0007	600	1510	8.15
Chronin	0.85	0.00027	900 (1100)	1425	8.50
Kruppin	0.85	0.00070 (20—100°)	500	—	—
Superior	0.85	0.00072	—	—	8.14
Phenix	0.83	0.0011	600	1510	8.10
Achenrain Resistance Materials. AW66 ...	0.66	−0.00001	Only for measuring instruments, etc.	—	7.85
Achenrain Resistance Materials. AW50 ...	0.49	0.00001	Only for measuring instruments, etc.	—	8.12
Rheotan CN	0.50	0 00...	500	1274	8.90
Rheotan	0.50	0.00022	400	1135	8.60
Constantan	0.50—0.52	±0 0001	—	—	8.92
Resistin	ca. 0.50	±0.000025	300	—	8.3
Ia Ia	0.48—0.50	0.00004 or less	—	1270	8 86
Ideal	0.49	0.000005	600	1210	8.9
Lucero	0.47	0.0007	600	1350	8.9
Manganin	0.43	±0.00001	—	—	8.3
Nickelin	0.40—0.43	{0.00022 0.00016}	400	1143	8.7
Nickelin I	0.41—0.43	{0.000067 0.000064}	—	1230	8.86
Achenrain Resistance Material, AW40	0·40	0.000106	—	—	—
German Silver	0.36—0.38	0.00022—0.0007	—	—	8.50
,, ,, soft	0.38	0.00019	—	1170	8.75
,, ,, hard ...	0.36	0.00020	—	—	—
Extra prima German Silver ...	0.30 (±4%)	0.00025	350	1055	8.72
Patent Nickel	0.335	0.002	—	—	—
N.30	0.30	0.00023	—	—	—
Nickel composition, soft ...	0.11	0.0041	—	1480	8.80
,, ,, hard ...	0.12	0.0039	—	—	—
Pure Nickel, soft	0.09	0.0042	900 (1000)	1440	8.85
,, ,, hard	0.10	0.0040	—	—	—

For temperatures from 500 to 900° C. the bracketed term is to be taken as zero.

The curves $I = f(t)$ for various diameters of wires are similar, with the axis of temperature as the axis of affinity. Hence, knowing the current as a function of temperature for, say, a 1-mm. wire, it is only necessary to multiply by a constant u in order to obtain the current as a function of temperature for any other diameter of wire. The constant u is independent of the temperature of the wire, and, in terms of the diameter d of the wire, it is given by—

$$u = d^{1.86} \quad \ldots \quad \ldots \quad (3)$$

(see also fig. 2).

We thus have :—$I^2 \rho = K = f_1(t) . f_2(d)$ and, by substituting for the functions—

$$I = (K/\rho)^{\frac{1}{2}} d^{1.86} \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

whc e K has the value given at (2).

This formula is reliable for values of ρ from 0·3 to 1·1 ohms/metre/mm.², and to some extent for values of ρ down to 0·18. Below $\rho = 0{\cdot}2$ the formula becomes somewhat unreliable because materials of such low specific resistance have generally a considerable temperature coefficient. In practice, however, the materials used for resistances and heating elements are those of high specific resistance within the range for which equation (4) is quite reliable.

The solution of equation (4) is somewhat tedious, but the charts in figs. 1 and 2 eliminate all but the simplest calculation. For example, suppose that it is desired to find the current I which will raise a 2-mm. Kruppin wire, stretched straight in air, to 500° C. The specific resistance $\rho = 0{\cdot}85$ ohm/metre/mm.² (see table), and from fig. 1 we see that the current for a 1-mm. wire = 9.15 A. From fig. 2 the factor u for a 2-mm. wire is 2·57, hence the current required is $9{\cdot}15 \times 2{\cdot}57 = 23{\cdot}6$ A. The makers' tables show the current for a 2-mm. wire at 500° C. to be 25·1 A, but the author's tests show the current to be 23·9 A, *i.e.*, practically identical with the calculated value.

Other results calculated in similar manner and all agreeing with measurements within 1 or 2% are as follows :—

To raise a 0·5-mm. Calido wire to 800° C. requires 5·36 A.
To raise a 2·0-mm. Calido wire to 400° C. requires 18·0 A.
To raise a 3·0-mm. Cekas wire to 400° C. requires 31·2 A.
To raise a 0·5-mm. Lucero wire to 300° C. requires 3·23 A.

The above results all relate to straight wires, but, in practice, the wire is often used in the form of spirals and, in the case of close-wound spirals, the mutual heating of adjacent turns is very appreciable. Actual measurements of the temperatures of spirals show the following formula to be reliable—

$$t_1 = t\,(1 + d^2/2{\cdot}1\,a) \quad \ldots \quad \ldots \quad (5)$$

where t_1 = temperature of the spiral ; t = temperature of a straight wire ; d = diameter of wire, in mm. ; and a = distance between the centres of adjacent turns, in mm. This formula, like the preceding ones, assumes that the wire is in free air ; nothing is said as to whether the axis of the spiral is vertical or horizontal, or whether this is immaterial.

Resistance elements often consist of strip metal, but this form is less often used in free air. The predetermination of the temperature of the strips is a rather complex problem. Equation (1) still holds good, but equation (2) must be modified, and equation (3) is no longer applicable. If, however, curves or tables be available for one material showing the current as a function of temperature for strips of various dimensions, it is easy to adapt these data to strips of other materials by aid of equation (1).

ELECTRICAL PROSPECTS IN INDIA.

By PHILIPPE E. PERONNE.

Manufacturers in general talk much of export trade; they frequently speak as if their existence depended on it, and yet in actual fact it is accorded comparatively little careful attention. Whilst, for example, it is perfectly true that Indian inquirers usually do not give a sufficiently complete description as required by manufacturers, yet this is really no excuse for referring the matter back. One or two prices should be given at least so that the inquirer may, in conjunction with some standard lists, form at least an idea on the subject. It frequently happens, on the other hand, that he is no better off at the end of some six weeks than at the start.

The scope of this article is briefly to discuss what openings exist at present and are likely to exist in future in India as regards electrical business and what means should be taken to gather these fruits to ourselves.

To proceed first with the second part: it is really astonishing to one who knows the country what little useful knowledge most people at Home really have of it. They are quite confused in their minds, for example, as to the different requirements of cotton and tea, or of Bombay and Calcutta, jumbling them all together under the heading, "India." In any case, they usually consider that they have done quite enough when their interests have been confided to "agents" from whom they have probably obtained a few orders or even inquiries in the past, but whose offices they have, of course, never seen and of whose activities they are in general in almost complete ignorance.

One large Indian firm had at least two dozen agencies; they employed less than a dozen commercial assistants in their several branches, and of these only two or three actually did any real travelling, the remainder being retained for office work, for their works, or for occasional erection. In all, perhaps, a single tour of the whole of India was made by the combined efforts of these two or three representatives who had this enormous list of agencies covering a very wide range of electrical, engineering, and other materials, including paints and oils! How was it possible for a single man to give adequate attention to every branch of every agency? No doubt the Home firms had in some cases contributed at least a proportion of an assistant's salary and were of opinion, naturally, that they were receiving proportionate service. Many a firm abroad simply takes agencies on the chance of a certain amount of commission arising, but has no facilities for really pushing its principals' interests.

Undoubtedly, one of the best procedures that could be adopted by those desirous of expanding their Indian business would be for one of their Home staff to be attached to some local English firm in either Calcutta or Bombay working in their own name, the representative reporting directly Home while keeping well in touch with his local controlling firm. The manufacturers would thus have at the same time a check on their own man and on the agents.

If, however, they could manage to send a man already possessing sufficient knowledge of the country, then their best plan would be to open their own office, which, indeed, could be done remarkably cheaply. The cost of rent and native staff is but little, and by the employment of suitable accountants out there a certain and sufficient idea of the general progress of the office can be secured. Such a representative, or agent, would, of course, be given a commission, in addition, and so would have a real interest in the business. In some cases it could be arranged for two or three non-conflicting manufacturers to co-operate in opening such an office. If preferred, a limited liability

company could be floated for the concern. Under suitable circumstances such an arrangement would pay hand over fist. When it is considered that the cost of a small but suitable office is only about £2 per week, of an English-speaking typist 15s. per week, that postage is cheaper there, as well as railway travelling (the first-class rail fare from Bombay to Calcutta is £8 and the second class £4 10s.), and when the representative's salary and railway expenses are divided between three or four firms it will be seen that the individual firms risk practically nothing at all, whilst they do receive in return assured first-class personal attention.

In the above, consideration has, perhaps, been given principally to the larger plant manufacturers; should those making smaller accessories not find it possible to co-operate with these in the manner suggested, it might be necessary for them to revert to the more customary procedure. A word of caution should be given, however: it is not necessarily the most prominent local electrical firm that will be the best agent; there is always some possibility of other electrical firms out there rather giving the line the cold shoulder on account of the general competition between the firms.

With the exception of specific articles, competition in the electrical industry in India from abroad is not felt very much. America was in a very fortunate position during the war as regarded plant, and Japan as regarded accessories, but neither, on the whole, may be said to have pleased the market. On the other hand, there can be no doubt that German products in a general way (*i.e.*, other than electrical) have in the past found a distinct favour with Indians, and that as a consequence there is a somewhat natural tendency on their part to look with a friendly eye on that country's electrical products also. Indians who come to Europe for commercial reasons frequently stop a longer period in Germany than in England. Several of the most prominent German manufacturers have now appointed agents. It has to be remembered that the average Indian is not affected by the same deep sentimental motives in the matter as we are: in fact, he may in some cases be even said to have a tendency in the opposite direction. With the prevailing tendency of the Government to include more Indians in its constitution, this is a factor that cannot be neglected.

Now as regards the possibilities in India: in the future, with the enormous population in that country, and its adaptability in certain circumstances to some European innovations of the luxury order, *e.g.*, cycles, phonographs, harmoniums, &c., there seems no reason to doubt but that electric light and fans will in course of time, and if wiring restrictions are not too rigorous, become almost a necessity to all, more especially in view of the prospect of cheap hydro-electric current in many districts. There are already in existence quite small "central stations" where the wiring is carried straight into the villagers' huts and charged for per point, as, for example, at Tezpur, Upper Assam. And in the long run there will be undoubtedly a very considerable demand for a reasonably cheap range of general wiring accessories, lamps, &c. The Indian has a very good memory for brands that have served him well, and in spite of all that may be said to the contrary will not buy the cheapest article irrespective of quality. It is precisely on this point that the Japanese have failed and the Germans have scored in the past.

At present, it is true, the majority of the railway and Government work does find its way to us, though even there one is beginning to hear complaints that the country of origin is no longer considered very material, and with the trend of events it seems that this will tend to become more so in future.

At present it is to be feared that Indians are rather inclined to laugh at our business methods in their country, as they involve so much expenditure, and it must be admitted that they themselves are frequently able to transact considerable business with but little expenditure of energy or money.

The writer has endeavoured briefly to show that there is a large latent market, well worthy of careful consideration, and that it is necessary to organise in every way open to the manufacturer in order to win the esteem of everyone not only as regards the actual article, but in all which concerns the marketing of it.

CONTROLLED ADJUSTABLE ILLUMINATION.

Mr. John I. Hall's System (Patented).

An interesting system of controlled illumination has been brought to our notice by Mr. John I. Hall, of Kingston-on-Thames, which possesses novel and useful features.

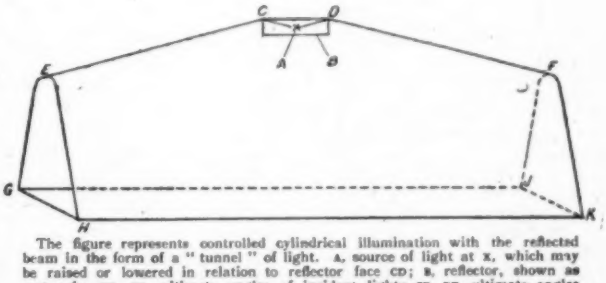
Mr. Hall has been experimenting for several years, and has developed a system of reflection which has for its object the conversion of radiation from a lamp from the spherical form to that (in its simplest form) of a long narrow band or beam, which may be a thin flat sheet of light, or may be adjusted and made wider to cover the width of the elongated area to be illuminated without waste of reflected light.

The difference in efficiency or distribution between this method and spherical radiation lies in the application of reflection. In radial distribution, says Mr. Hall, the direct light reaches to greater distance than the reflected light, while in this new method the reflected and direct light are coincident in direction, thus securing higher illumination at greater distances where, by natural law, light is of least value; hence a higher efficiency is obtained.

The long beams of light provided by the apparatus vary in intensity and are capable of providing the smallest illumination or projecting powerful beams required for searchlight projectors.

In the course of a recent demonstration of a 5.3-c.p. vacuum lamp and reflector, throwing a beam of light along a corridor 75 ft. long by 4 ft. 6 in. wide, the beam was first adjusted to the width of the floor, and was of the same width the whole length, giving a striking illumination from so small a source. By adjusting the beam to half the width of the corridor, the illuminated strip of light along the floor was made 2 ft. 3 in. wide and of higher illumination. Mr. Hall states that this reflector, placed 20 ft. high, gives 0.07 foot-candle at 10 ft. distance on either side of the lamp along the floor, and at 25 ft. distance 0.025 foot-candle, the angular opening of the beam being adjusted to 10 deg. Two such lamps, placed 50 ft. apart, give a minimum illumination of 0.05 foot-candle midway between at ground level. Two 20-watt vacuum-controlled reflectors placed 26 ft. apart and 9 ft. 6 in. high, for lighting a corridor 4 ft. 6 in. wide, give 0.56 foot-candle mean illumination at ground level.

Mr. Hall points out that to apply spherical (uncontrolled, or with the ordinary type of reflectors in general use) radiation to illuminate an area 50 ft. long and, say, 5 ft. wide, is analogous to placing a hemisphere 50 ft. in diameter over the elongated space; the greater part overhangs the sides of the space, and this overhang represents wasted light. The object of his system is to reduce the loss represented by this "overhang" by reducing the energy employed, to increase the



The figure represents controlled cylindrical illumination with the reflected beam in the form of a "tunnel" of light. A, source of light at X, which may be raised or lowered in relation to reflector face CD; B, reflector, shown as rectangle; XC, XD, ultimate angles of incident light; CE, DF, ultimate angles of reflected light; EGH, FJK, vertical planes intercepting controlled beam; GH, JK, elongated illuminated space on screen or ground, sides of which are parallel when axis of reflector is parallel with surface illuminated. By raising or lowering X in relation to reflector face, the sides GJ and HK become wider or narrower. Inclinations of beam CE, DF, are usually 1 in 12, and if reflector is 10 ft. high, points E and F touch ground at 240 ft. distance.

Fig. 1.—Diagram of Reflector Scheme.

efficiency of reflection and to distribute the reflected light only along the space to be illuminated.

This object is attained by the use of a sectional part of a cylindrical reflector, which has been found to give, by this system, a very high efficiency of illumination. The lamp is generally placed midway under the concave surface, in an adjustable mounting, as shown in figs. 1 and 2, from which it will be seen that almost the whole of the luminous flux from the lamp is directed downwards upon the elongated space beneath, which it is desired to illuminate, and that the bulk of the reflected light is directed towards the ends of the

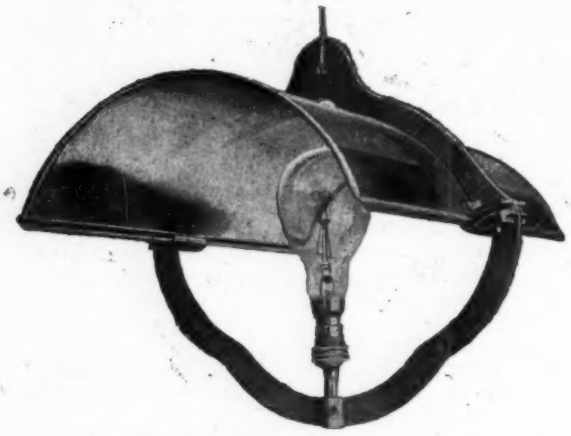


Fig. 2.—Hall Reflector for 100-watt Lamp.

space, say a corridor, gangway, platform, or sign, the result being a very fair approximation to uniform illumination from end to end from a single lamp.

We understand that the efficiency of this method of controlled reflection is very high compared with spherical radiation. The inventor has supplied apparatus giving an economy of 50 per cent., with higher and more even illumination, and in some special cases economies have been obtained in actual practice up to 73 per cent. in current consumption; in one case a demonstration was given showing a saving in the ratio of 10 to 1. A very considerable order was recently executed by him for apparatus where one 40-watt lamp was to be used in place of three 30-watt lamps, a higher and more even illumination being obtained; and as compared with a high-reflecting method consuming 480 watts, a 200-watt controlled reflector gave equal illumination.

For lighting a sign 120 ft. long, placed 50 ft. high on the top of a factory, two 200-watt reflectors were placed at a distance of 85 ft. on the opposite side of a yard, which the reflector was also designed to illuminate.

Obviously the same wattage may be used, and the illumination very greatly increased, or the same standard of illumination may be maintained with a lower expenditure of power.

The inventor claims that there is scarcely any problem in lighting to which this system is not applicable, and it has been applied with marked success to the lighting of bakers' ovens by means of 30-watt lamps; Messrs. David Atkins, Ltd., of the Scotch Café, Kingston-on-Thames, had four ovens equipped in the early part of this year, this being an interesting example of the successful solution of a very difficult problem in lighting. The mean illumination obtained on the four ovens was one foot-candle. Another application is that of providing even illumination over flat surfaces, such as drawing boards and tables for large and extensive plans. For street and open-space lighting, the reflected beam varies in intensity, the higher intensity being directed across and along the roadway.

We understand that one of our principal tramway authorities placed 60-watt lamps 65 ft. apart, 22 ft. high, and on test obtained an illumination of 0.9 foot-candle below the lamps, and 0.2 foot-candle midway between, on a plane 3 ft. above the ground. On the test coming out so satisfactorily, an order was placed for "controlled" apparatus for lighting a new car depôt.

A totally different field in which it is proposed to use the Hall system is in connection with searchlights for aircraft operations, aerodrome lighting, illuminating ground around camps, or for surrounding warships with a pool of light, and also for coastal and harbour defence. In each of these cases a wide sheet of light having little thickness is required in order to utilise the luminous flux efficiently. Mr. Hall terms this high-power application "barrage projection." When directed upwards, the beams may be either fixed or oscillating or arranged to revolve, so as to sweep over a large area. He is working out a scheme for the establishment of such barrages along the coast and around London to afford protection against night attack by aircraft.

Other applications to which controlled projection is applicable are the illumination of building façades, poster hoardings, signs, bowling greens, tennis courts, private gardens, monuments, &c.

Much ingenuity has been expended by the inventor on various designs of reflectors and fittings which he has developed, and he recently afforded us an opportunity of inspecting some of his apparatus in operation, when we were much impressed with the effects obtained with comparatively small sources of light.

THE HYDRO-ELECTRIC DEPARTMENT OF TASMANIA.

Report for the Year 1922-23.

The Tasmanian Government Hydro-Electric Department is divided into two separate parts, each of which has a separate trading account. The Operation Branch during the year ended June 30th last, earned a total revenue of £95,487. Of this total the major part (£64,000) was derived from the sale of power in bulk; for the rest the Hobart District Branch (the retail department of the undertaking) was mainly responsible. The working expenses of the Operating Branch amounted to £17,558, and the result was thus a gross profit of £77,929. The Hobart branch earned a revenue of £78,222. The expenditure totalled £46,517, the principal item being, of course, the purchase of power from the other branch (£30,618). The gross profit was therefore £31,705. This sum and the profit from the Operating Branch were transferred to a main joint account, and to them was added interest amounting to £220, making a total of £109,854. Against this were charged interest, depreciation, &c., and a net profit of £2,040 remained.

The report of the chief engineer (Mr. J. H. Butters) states that the Great Lake Dam was completed during the year, including the installation of pipe lines. The power station was also completed, tested, and put into operation. The stand-by steam plant at Devonport made considerable progress. The expenditure on construction work during the year amounted to £214,870, the principal item being £158,003 spent upon the main Waddamana development. Referring to the industrial concerns, upon which the success of the undertaking so largely depends, Mr. Butters states that the large works of the Electrolytic Zinc Co. were completed during the year, and the commencement of the full supply of 30,000 h.p. commenced at the beginning of the present year. The works of Carbide & Electro-Products, Ltd., were in operation for nine months out of the twelve. It is Mr. Butters's opinion that this company will not be fully successful until a duplicate furnace is installed to enable the full Australian demand to be met. Mention is made in the report of the favourable prospects for the production of wood pulp which could be cheaply produced by means of hydro-electric power. Two large woollen mills were started up and it is thought that others will follow.

The chief official of the Operation Branch states that the maximum demand upon the generating station was 31,700 kW,

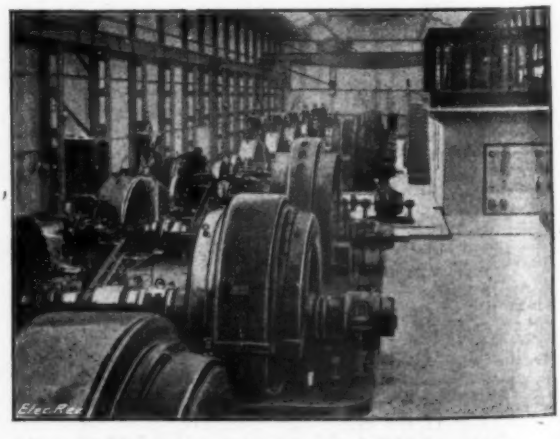


Fig. 1.—The Waddamana (Tasmania) Power Station.

an increase of 41.2 per cent. over that of the previous year. The energy generated (191,413,500 kWh) was more than double the previous year's output. The accompanying illustration (fig. 1) is a view of the interior of the Waddamana power station. The eight generators shown have an aggregate capacity of 66,000 kVA.

ELECTRICAL IMPORTS OF BRITISH MALAYA.

BELOW are given the values during 1921 and 1922 of the imports of electrical and allied material into the Straits Settlements, Federated Malay States, and Non-Federated Malay States (the Straits dollar=2s. 4d.). The countries indicated are those from which the goods were consigned, and are not necessarily the countries of manufacture.

	Straits Settlement Colony.		Federated Malay States.		Non-Federated Malay States.	
	1921	1922	1921	1922	1921	1922
	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.
Electrical Machinery—						
Total	2,591,000	1,304,000	531,000	493,000	24,000	7,000
From United Kingdom	1,859,000	1,004,000	485,000	445,000	23,000	7,000
,, India	10,000	7,000	—	—	—	—
,, Germany	4,000	45,000	—	2,000	—	—
,, Italy	71,000	71,000	—	11,000	—	—
,, Japan	65,000	42,000	—	—	—	—
,, United States...	489,000	91,000	—	2,000	—	—
Engines, Boilers and parts—						
Total	2,170,000	778,000	2,032,000	155,000	243,000	10,000
From United Kingdom	1,730,000	631,000	2,028,000	150,000	243,000	10,000
,, Germany	2,000	18,000	—	—	—	—
,, Holland	44,000	38,000	—	—	—	—
,, United States...	109,000	6,000	3,000	3,000	—	—
Machinery, other (not sewing machines)—						
Total	4,528,000	2,081,000	7,427,000	5,035,000	78,000	21,000
From United Kingdom	2,997,000	1,383,000	4,843,000	3,620,000	71,000	21,000
,, Australia	229,000	241,000	1,295,000	1,043,000	—	—
,, Denmark	26,000	79,000	—	2,000	—	—
,, Germany	12,000	45,000	—	9,000	—	—
,, Japan	29,000	16,000	—	—	—	—
,, United States...	786,000	176,000	1,115,000	285,000	—	—
Telegraph and telephone material—						
Total	786,000	911,000	1,435,000	443,000	46,000	12,000
From United Kingdom	759,000	890,000	1,435,000	443,000	—	12,000
,, Sweden...	5,000	10,000	—	—	—	—
Tramway and railway materials—						
Total	848,000	234,000	1,440,000	1,550,000	4,000	1,000
From United Kingdom	261,000	187,000	1,389,000	1,541,000	4,000	1,000
,, Australia	104,000	22,000	—	9,000	—	—
,, Italy	17,000	13,000	—	—	—	—
Lamps and lampware—						
Total	535,000	342,000	124,000	26,000	—	8,000
From United Kingdom	189,000	71,000	104,000	19,000	—	3,000
,, Belgium	1,000	4,000	-	500	—	400
,, Germany	57,000	92,000	—	—	—	—
,, Holland	28,000	15,000	—	1,000	—	—
,, Japan	132,000	104,000	—	—	—	—
,, United States...	86,000	23,000	19,000	5,000	—	—

THE EMMET MERCURY BOILER.

A GREAT step forward is represented in the recent starting-up of a mercury boiler and turbine at the Dutch Point Station of the Hartford Electric Light Co., where it at times carries as much as 1,500 kW. Experiments are still proceeding, but the prospect seems to be very good that the equipment will soon be put into commercial service.

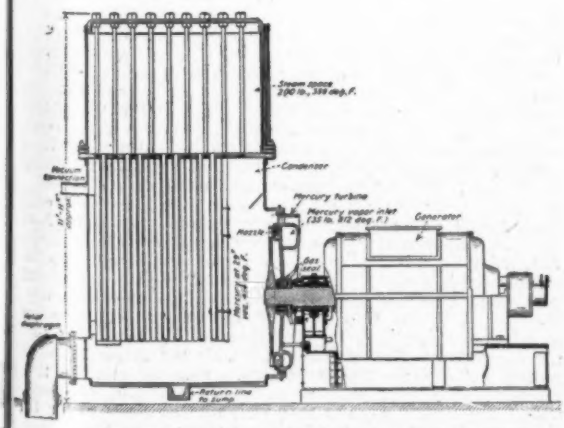


FIG. 1.—SECTION THROUGH TURBINE AND CONDENSER.

The boiler is the design of Mr. W. L. R. Emmet, well known in connection with the electrical propulsion of battleships. Not only had Mr. Emmet to work out by experiment the design and methods of construction, but the thermodynamics also had to be established to some extent. The Hartford boiler is the fifteenth design which has been constructed, the others having been tried out, with varying degrees of success, in the General Electric Co.'s works, Schenectady. Some of these designs have embodied the fire-tube principle, like the Hartford boiler, while others have been of the mercury tube type. With each the aim has been to construct a boiler that will not require a prohibitive amount of mercury, will not overheat, and will be free from injurious expansion strains; moreover, all joints must be welded to prevent the escape of mercury vapour to the atmosphere and the ingress of air into the system, which would produce oxidisation; and, finally, the circulation must be such that all liquid will immediately return to the boiler. The problem of designing the turbine has been comparatively simple.

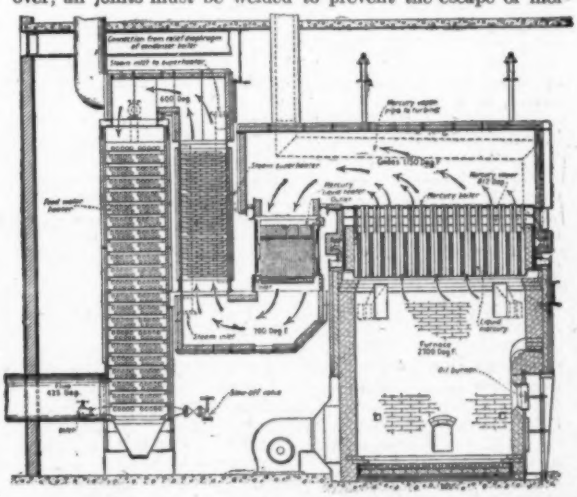


FIG. 2.—SECTION THROUGH BOILER, HEATER, AND SUPERHEATER.

Briefly, the process provides for the evaporation of mercury in a boiler (at 35 lb. gauge and 812 deg. F. in the present

case), expanding the mercury through a turbine, and utilising the heat of the exhaust (at 29 in. vacuum and 414 deg. F. in the Hartford boiler) to generate steam, which is put through a separate turbine or supplied to the station main, as at Hartford. This system results in a thermal efficiency approximating to that of the internal combustion engine. If it is compared with a steam turbine plant running at 200 lb. steam pressure and with the highest standards of efficiency in turbines and auxiliaries, the mercury-steam combination with mercury at 35 lb. gauge, should, according to Mr. Emmett, give about 52 per cent. greater output of electricity for equivalent fuel consumption; and if in such a plant the boiler-room is equipped with furnaces and mercury apparatus arranged to burn 18 per cent. more fuel, the station capacity with the same steam turbines, condensers, auxiliaries, &c., would be increased by about 80 per cent. In comparison with stations operating under higher steam pressures the gain would, of course, be less.

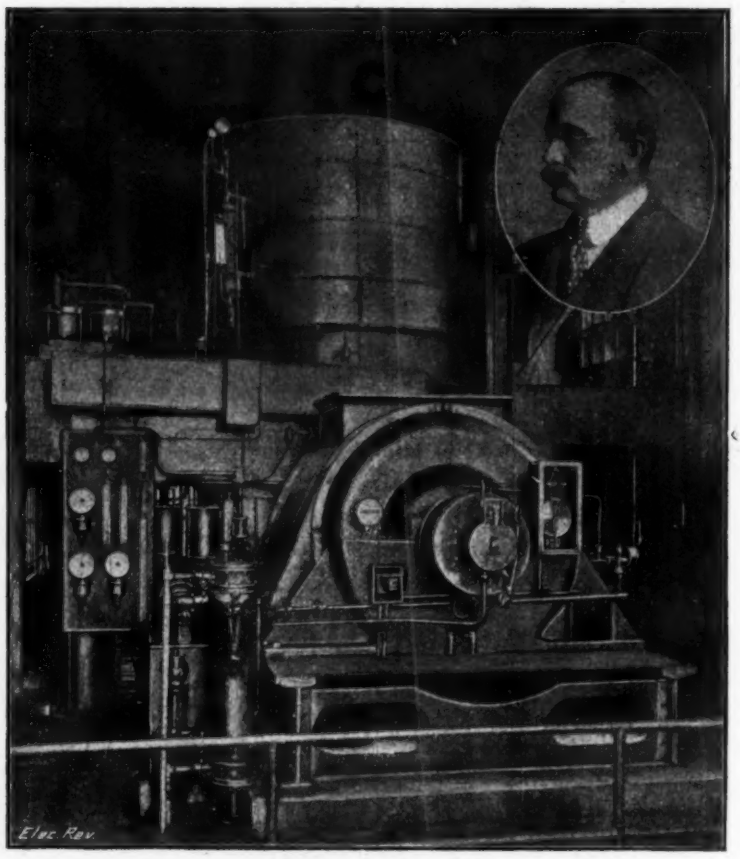


Fig. 3.—General View of the Hartford Installation. (Inset: Mr. W. L. R. Emmet, the Inventor.)

Figs. 1 and 2 represent sections through the equipment as installed at Hartford, with the approximate temperatures indicated. The turbine and mercury condenser (steam boiler) are above the mercury boiler, so that the condensed mercury returns by gravity and thus eliminates the feed pump. The only pump in the system is a vacuum pump of the water-seal type, which sucks through a screen. The boiler is oil fired and the flue gases, after passing up through the mercury boiler, are led to a mercury heater or economiser, thence over the steam superheater to the feedwater heater, and finally to the chimney stack, at the base of which is an induced-draught fan. The mercury vapour passes through the boiler to the turbine, which is of the single-stage impulse type and is expanded to a pressure corresponding to 29 in. of vacuum. From the condenser the liquid mercury flows into a sump and drains back into the boiler. The mercury boiler is of the vertical type, cylindrical in form, and has a single tube sheet, into which the tubes are expanded and then welded; the lower ends are free to expand. The lower two-thirds of each tube is hexagonal in shape, with the sides slightly curved. These curved sides of adjacent tubes are placed tangentially to one another and are welded together at the lower edges, thus taking the place of a bottom tube sheet. The interstices between the tubes hold the mercury. By this arrangement a maximum of heating surface is obtained with a minimum amount of mercury. The present boiler holds about 30,000 lb. of mercury and is designed to evaporate 230,000 lb. of mercury per hour. At this rate the turbine would develop 1,900 kW and deliver about 28,000 of steam per hour at 200 lb. pressure and 100 deg. superheat. It has been considered expedient to run the Hartford equipment at a reduced load.

In general design the mercury turbine is not unlike a steam turbine except that the blading is of tool steel to resist the cutting action of the mercury, and the glands are sealed with illuminating gas. The turbine is bolted to the side of the condenser and then welded. When it is found necessary to shut down the unit the illuminating gas is turned into the system and thus prevents the infiltration of air, which might cause oxidisation of the mercury.

Like the mercury boiler, the condenser consists of a vertical cylindrical shell with the tubes rolled and welded into a single upper tube sheet. The tubes are closed at their lower ends but are not attached to one another. In this way provision is made for free expansion and contraction.

The mercury sump is also under a gas seal and is provided with an ingenious form of strainer consisting of slanting baffles, which project into the liquid and carry a wire mesh on their undersides. Any oxide that may be floating on the surface of the mercury is thus caught by the baffles.

The Hartford installation has two major limitations. The boiler, as constructed, is inaccessible for cleaning, and the steam pressure, as governed by the existing station conditions (200 lb.) is relatively low. Thus the corresponding temperature involves a lower pressure in the mercury condenser and a greater drop through the turbine than is desirable for highest efficiency in a single-stage machine. Consequently, another boiler is being designed. This will be of the inverted V-type, in which the mercury will be contained within the tubes and the gases will pass over them. The lower headers will be so arranged that the bottom part of each can be easily severed with a cutting tool, the tubes cleaned, and the head welded on again in a comparatively short time. Moreover, it is expected to install this later boiler where the steam conditions will be such as to permit operating the mercury turbine under a more favourable pressure range.

A general view of the Hartford installation appears in fig. 3. For this, and the foregoing particulars, we are indebted to our American contemporary *Power*.

Australian Electrical Appointments.—We quote the following comment from the *Commonwealth Engineer* for November:—"When Government departments advertise for engineers there is an implied moral obligation on the part of the Government to applicants for the positions, and a prompt announcement should be made either that the position has been filled or that none of the applicants was considered suitable. Engineers would then know just how things were, and they would be free to look elsewhere. Too often, hoping against hope that a position for which they have applied may come their way, they refuse other offers, and, like the dog, drop the bone to catch the shadow. These remarks are suggested by two important positions advertised in Victoria. The railway department more than six months ago invited applications for an assistant chief electrical engineer, salary to be arranged. Applications closed on April 30th, but no appointment has yet been made. The Victorian Electricity Commission advertised for a power-house superintendent at Yallourn, the salary offered being £750; but here again no appointment has resulted. In the latter case, perhaps, it is not surprising, as the salary offered is not at all in keeping with the technical qualifications demanded for an engineer of experience and with the responsibility of controlling a large power station. Smaller stations than Yallourn are paying more to their superintending engineers, and if the Victorian Electricity Commission hopes to get the right man it will have to offer more money. In this connection it has to be remembered that Yallourn is in the bush, and the engineer who takes the position should receive a larger salary than he would in one of our capital cities. The Institution of Engineers should have something to say on the question of salaries, and might also make representations to the Victorian Government on the question of speeding up appointments to these positions."

ELLISON HAND-OPERATED 6,000-VOLT SWITCHGEAR.

Free-handle Oil Breakers in Steel-frame Cubicles.

It is of interest to recall that Mr. George Ellison made high-pressure switchgear as far back as eighteen years ago on a fairly large scale, and where he has kept in touch with such gear he knows it to be in satisfactory operation. It will thus be appreciated that he is not without practical experience in this field. His firm has produced a new design of hand-operated, 6,600-volt, free-handle switchgear (suitable for currents up to 250 amperes), in steel-frame cubicles, that is intended for use in sub-stations in outlying districts and in consumers' works.

One of the accompanying reproduced photographs, fig. 2, is a view of such gear installed in the Northfield sub-station of the City of Birmingham's electricity undertaking, while the first illustration shows that the gear consists of a busbar chamber, isolating plugs, and an oil circuit breaker that is made to lower instead of draw out.

The overload coils are immersed in the oil tank and are direct connected; they are insulated to withstand the full test pressure in air. A single handle opens and closes the breaker, and is interlocked with the lowering mechanism to ensure that the breaker is open while making or breaking circuit at the isolating plugs; the lowering mechanism also operates an insulating slide which covers the "live" isolating contacts when the breaker is down. The standard breaker is three-phase, but a two-phase type is obtained by omitting one pole; it can have a maximum of four coils, say, three overload and one shunt trip. When the overload coils are omitted it becomes a quick-break oil-immersed switch with high breaking capacity.

A switch of this sort is frequently required to isolate a feeder or busbar section, and as the standard switch with phases at right angles to the front of the cubicle sometimes means awkward connections to the busbars, a variant, to which trip coils are not fitted, has been developed with the phases parallel to the cubicle.

The busbars are round copper rods enclosed in reinforced synthetic resin tubes with porcelain cylinder insulators, and reinforced synthetic resin sheets separate each busbar chamber from its neighbour. Copper isolating plugs, enclosed in reinforced synthetic resin tubes, are threaded through insulators in the base of the busbar chamber and make the connections in the isolating chamber; there is, therefore, double insulation at the boiler-plate partition. The whole upper portion, comprising the busbar and isolating chambers, is a boiler-plate and angle-iron structure, supported by tubular stands resting on the floor. The operating mechanism is simple: a cross-head carrying contact rods and sliding in vertical guides is linked to the usual levers and toggles transmitting the motion from the handle to the cross-head with the usual catches for the free-handle device and overload release; downward movement releases the catches, permitting the breaker to open quickly under the influence of gravity and of the accelerating springs. The overload plungers act on a trip rod, releasing a catch.

The upper edge of the body casting makes a weather-proof and dust-tight joint with the lower part of the isolating chamber; in the bottom of the body casting is a small valve normally open downwards to return to the tank any oil which may collect in the terminal chamber, but which closes when pressure exists in the oil tank. If the oil in the tank just reaches the bottom of the body casting the only air space is an annular space 1¾ in. by ¼ in. Four holes in the body casting communicate with this air space, so that first the air and then the oil is expelled through the vent holes into the box-like body casting when heavy pressure is set up by an arc in the oil tank and the oil drains back through the valve into the tank when the pressure is relieved.

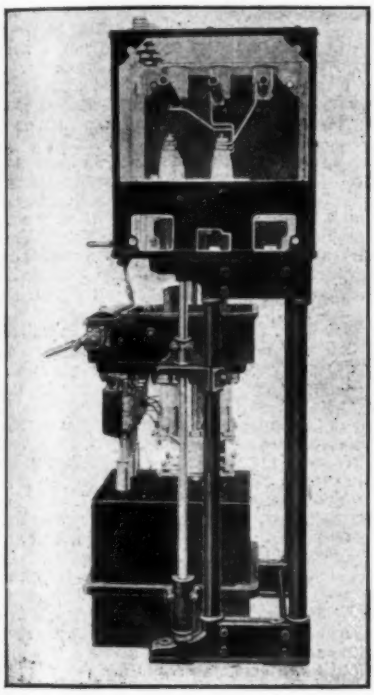


Fig. 1.—Ellison Drop-down H.P. Switchgear.

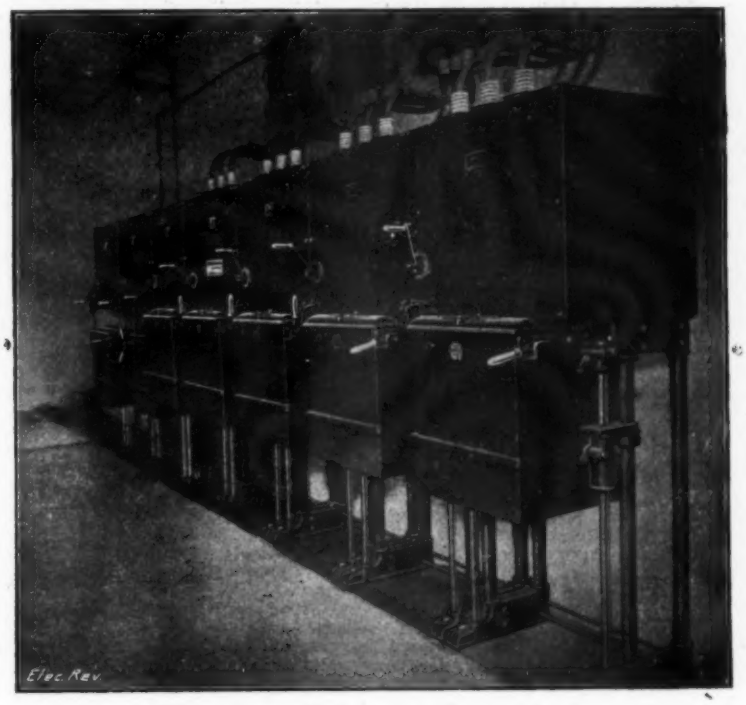


Fig. 2.—An Installation of the New Ellison Gear at Northfield, Birmingham.

The first few turns of the lowering mechanism lower both breaker body and tank a sufficient distance to withdraw the sockets from the plugs and operate the slide covering the live parts; at this stage the body comes to rest on projections on the stands and further rotation of the handle lowers the tank only.

The casting carrying the overload coils, &c., is inside the oil tank, there being about 2¼ in. head of oil above the coil winding. The overload cores, adjustment tubes, and time lags are the standard design; they are immersed in oil, but separated from the main body of oil by a wood partition.

American Power Development.—*Science*, in a recent issue, says that interest in projected super-power development in the north-eastern States, with high-pressure transmission lines running from immense power plants at the coal mines to the great industrial centres, has overshadowed the real progress toward super-power development which has been made in other parts of the country. There are now only four gaps with a total extent of 25 miles in a continuous electric power system along the Pacific Coast from British Columbia to Mexico, a distance of 1,400 miles. Five of the south-eastern States are included in another super-power development which furnishes hundreds of thousands of horse power, and extensions are projected into neighbouring States.

MODERN TRANSFORMER CONSTRUCTION.

A New Remedy for Shrinkage Troubles: the Use of Langite.

(Communicated.)

With the increasing use of electricity for all purposes and the centralising of power stations, high-pressure transmission is becoming more general, and necessitates the use of more, and better, static transformers of all types; hence very careful consideration is being given to their design and construction in order to eliminate existing defects and to cope with the more severe service conditions now existing.

The designing engineer is faced with ever-growing problems, one of the most important of which is that of holding the windings together rigidly under all conditions. This is essential, to protect the coils and insulation from mechanical damage due to short-circuit or sudden load shocks. Should the windings and insulation be subjected to these shocks and at the time be not rigidly held to withstand such shocks, the coils will move and so become damaged, and an electrical fault will undoubtedly follow. The above requirement necessitates that all windings must be "unshrinkable," or that all shrinkage should be automatically taken care of.

Various methods are adopted to endeavour to ensure the rigidity of the windings; these are briefly as follows:—

Transformers in many cases are provided with clamping split rings on the primary and secondary windings, and these are held in position by adjusting screws. This is one of the earlier methods devised for overcoming the shrinkage. It is still employed in many transformers for moderate voltage where shrinkage is not excessive, and where periodic inspection is possible and so permits of adjustment at the same time.

A further method is to assemble along with the windings helical or spiral springs acting on stiff steel split rings. The springs are placed at different parts of the windings, according to the ideas of the engineer. In some cases they are put in the middle of the coils of a core-type transformer, while others fit them at the top, or at the top and bottom. These springs automatically follow up the shrinkage, being assembled at full compression, until the shrinkage exceeds the spring expansion.

A more modern practice is the use of dash-pots in conjunction with springs, the dash-pots being fitted with adjusting screws which can be used in the event of the shrinkage being excessive. This method is employed by one large British firm, and the reason for its use is briefly as follows:—While the springs undoubtedly follow-up the shrinkage, they do not hold the coils rigid under all conditions. If the transformer is subjected to a heavy short-circuit, the mechanical forces expended act on the coils, and these in turn act on the springs. While the springs offer a certain amount of resistance to the coils, depending on their condition, they will recoil to the full amount until completely closed. The coils due to this spring recoil are thus free to move during the instant of short-circuit. With a dash-pot fitted either internal or external to the spring, the sudden recoil of the spring is prevented, and the coils are thus held rigidly in place during the short-circuit.

The aim of the engineer is now to supply transformers with unshrinkable windings, and thus eliminate all mechanical adjusting devices. The unshrinkable winding is the ideal, for if it could be obtained, great advantages would accrue.

The definition or requirement of a so-called "unshrinkable" winding is: one which, together with its insulation, does not during normal service conditions contract or become free to move on the core or limb on which it is assembled.

There are two points of view that can be considered in attaining the above requirement:—

1. The coils may be made rock hard and the insulation used can be of an incompressible nature.

2. The coils may be made as now manufactured, and the insulation in part built up of a resilient material.

Either of the above methods would attain the required end, but as yet no definite results have been achieved in practice.

The advantages to be gained by an unshrinkable winding are briefly as follows:—

1. Financial saving, by eliminating mechanical parts, and by reducing active material (*i.e.*, the core) taken up by the mechanical bracing rings, &c.

2. Higher efficiency, due to less quantity of active material.

3. Lower core losses, and hence less running costs.

4. Less oil or cooling medium, due to lower losses.

Many attempts have been and are still being made to produce the unshrinkable winding.

To follow the problem more closely, it is necessary to analyse the cause of shrinkage. This trouble is chiefly experienced with core-type transformers, and as this is the more common type for average sizes, it is this type that will be considered. The shrinkage here is due to several causes:—

1. The weight of the windings themselves acts in the direction of shrinkage, and thus compresses all material in the assembled winding.

2. The insulation is under compression from the weight of the coils and the initial pressure exerted during manufacture, and gradually compresses.

3. The hot oil softens the insulation and thus permits settling down.

4. The varnish on the coils softens slightly in hot oil and thus becomes compressed under pressure, and in some instances the varnish is absorbed partially by the hot oil.

The higher the voltage a transformer is wound for, the greater the possibility of shrinkage, and experience shows that after all possible shrinkage has been taken out of the windings and insulation during manufacture a further shrinkage is apparent after six months' continuous service; on a 20,000-volt winding this may be about 1 per cent. or 2 per cent.

One large American firm already claims that it has obtained the unshrinkable winding, and this may be correct.

If all coils were bakelised and hard bakelite insulation were used throughout, an unshrinkable winding would probably result. This is a very expensive process of manufacture, and one not yet favoured, due to the unreliable results of such a process from a dielectric point of view.

Unshrinkable windings have been made by spirally winding the coils of thin ribbon wire on hard insulating cylinders, which have then been axially pressed. This method is satisfactory within limits, depending on the size of copper ribbon used. The success of the method is due to the fact that a minimum of insulation in an axial direction is used.

The more common practice is to assemble the coils and insulation in the usual way and age them by heating the assembled windings under pressure in vacuo and then in oil, and by so doing forestalling all possible shrinkage. This method is not perfect, for it tends to strain the windings and insulation, and thus risks reducing the life of the transformer. It can be assumed that the problem is still commercially unsolved—that is, considering it from the first point of view.

The alternative method of attaining a rigid winding is more hopeful, if a material that is resilient and at the same time a dielectric can be obtained. A material of this nature could be used as end insulation, and also be interleaved between the windings.

Windings thus assembled could be put under initial compression, and as the shrinkage occurred the resilient material would expand and so always keep the coils tight and rigid.

The Metallic Construction Co., of Manchester, states that it has placed a material on the market known as "Langite," which will apparently meet with the above requirements. It is composed of a certain type of cork bonded together by an oil-resisting medium under a patented process.

This material is resilient to a remarkable degree; it is a dielectric, and does not disintegrate in hot oil. Owing to its resiliency and peculiar nature, it can be compressed to one-fourth of its original thickness without extrusion and again resume its normal section when relieved. To give an idea of its properties, the following tests made on a rough piece of material are quoted:—

One piece of Langite, ordinary grade, ¾ in. thick in an undried state stood a test of 24,000 volts. After immersion in oil and being put under vacuum, the test voltage was raised to 37,000 volts, and the material absorbed 70 per cent. of its weight of oil. A piece of material ¾ in. thick was compressed to ¼ in. under oil; on release it was found to have absorbed 50 per cent. of its weight of oil, and stood a test pressure of 32,000 volts.

Langite being composed of cork, is by nature a material having numerous cells, so that when it is under compression these cells are closed and the air is in part excluded. If immersed in oil under compression, the material will absorb oil in place of the excluded air when the pressure is released.

If a transformer be built up with layers of this material at the top and bottom of the winding, and, if thought necessary, between the windings, then if built under pressure the windings and insulation could be said to be "unshrinkable"; as the usual shrinkage took place, the Langite would expand and thus keep the coils rigidly held together.

If a short-circuit occurred, the coils would be cushioned by the Langite, and the absorbed oil would prevent sudden recoil in a similar manner to the dash-pots already described.

It is stated that this material is adaptable for use in all shapes and thicknesses that would be required for transformer manufacture.

This method of counteracting shrinkage can be used in the smallest as well as the large sizes, and so is expected to be more useful on that account, giving all transformers a means of protection and greater rigidity and robustness, ensuring longer life and efficient service.

Another property of Langite is that of absorbing vibration and consequently noise. This suggests to the mind of the engineer that it would possibly reduce the "hum" in transformers if used, say, partially in place of paper or other insulating material in the magnetic core of a transformer, and it might also be useful in the air-gaps of cores used in choking coils.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Kingsway" Watertight Wiring System.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has brought out a development of its "Kingsway" wiring system, which makes it adaptable to installations where it is necessary to make the wiring system watertight. The principal part of this new departure is the special gland, illustrated in fig. 1. The body of this is a screwed brass plug with a hole through its centre of oval or circular shape, according to whether multi-core or single-core metal-sheathed cable is employed. A wide slot is milled across one end of the plug, and into this a washer fits. This washer has a hole in it corresponding to that in the plug, and it is clamped to the plug by a hexagon nut. A lock-nut is used to fix the plug to the junction-box or other fitting to which it is applied. In fixing the gland the metal sheath of the cable is removed where necessary, as usual, and the nut and washer are slipped over the end. A short length (three or four turns) of 18-gauge pure lead wire is then wrapped round the cable sheath near the entrance hole of the plug, and the washer is pushed into position and clamped. The pressing of the wire into the recesses between the cable and the body of the plug makes a perfectly watertight joint and ensures continuity.

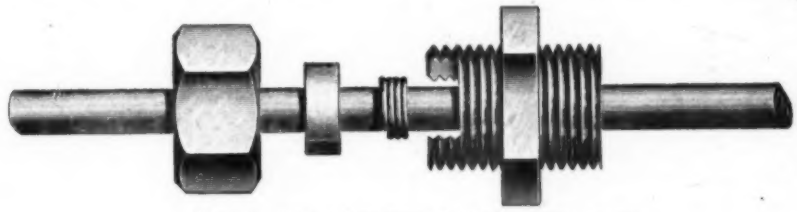


Fig. 1.—The "Kingsway" Watertight Gland.

Fig. 2.—The "Factory"-type Wall Plug.

The junction boxes are rendered watertight by means of a rubber ring between grooved flanges, and this is applied, of course, to other fittings, as pendants, switches, &c. Among the fittings which may be employed with the system is the "Factory" type wall plug illustrated in fig. 2. This plug is inserted from below, has no projecting pins, and even if used as the live end, may be dropped on the floor without danger. Earthing connections are provided on both plug and socket.

The Improved "Meg" Insulation Tester.

It will be recalled that in our issue of October 13th, 1922, we described the "Meg" insulation tester, a new product of Messrs. Evershed & Vignoles, Ltd., of Acton Lane Works, Chiswick, W.4. Such drastic reductions in weight, dimensions, and price as are represented by this machine were only rendered possible by concentrating on absolute essentials, discarding all the refinements which have contributed to the fame of the larger "Megger" testing sets. In view of the general appreciation which has been accorded to the lighter instrument, however, efforts have been made to extend its scope and utility, without sacrificing lightness and convenience, by the incorporation of a constant-pressure clutch in a modified form, and the instrument embodying this improvement will be placed on the market on January 1st.

From the accompanying figs. 3 and 4, it may be seen that the constant-pressure "Meg" differs little in general appearance and size from the original instrument. The only change is the introduction of a "Sandwich" unit between the generator and the gear casing. This unit carries the copper driving drum of the clutch, and the intermediate gearing and stud, transferred complete from its previous position on the generator frame. The other clutch member is attached to the armature spindle and consists of a plate carrying spring-controlled levers and pressure pads, so arranged that the driving elements will separate under centrifugal action when the armature speed exceeds a predetermined limit. Normally, the speed at which this occurs corresponds to about 500 volts.

Specially made roller bearings provide for long life of the generator at the high speed (approximately 4,500 r.p.m.) at which the armature runs, and at the same time allow the armature clearance to be a minimum. With the addition of the clutch, the complete instrument weighs only 7¼ lb., whilst the overall measurements when open ready for use are 5¼ in. x 6½ in. x 8½ in.

In a large variety of work the capacities encountered are so small that the correspondingly minute capacity currents do not interfere with a steady reading, even when a variable-pressure testing instrument is used. When, however, the capacity reaches the order of 1 microfarad, a steady reading becomes increasingly difficult to obtain, unless some method of controlling the testing voltage is introduced. This is effected automatically and within narrow limits by the constant-pressure clutch, so long as the handle of the generator is turned at a speed exceeding that at which the clutch can be felt to slip. By this means the scope of a testing set may be extended to cover circuits consisting of long runs of cable, metal-sheathed wiring, armoured cable, &c.

Another important advantage of the improved instrument is that it is impossible to overstrain the insulation under test, whereas with the variable-pressure generator two or even three times the rated voltage may be obtained by turning the driving handle sufficiently fast.

Fig. 3.—An Improved "Meg" Tester.

Fig. 4.—The Constant Pressure "Meg."

The "Crescent" Terminal.

All ordinary terminals designed to grip the conductor between flat or plain surfaces have the tendency in practice to throw out the wire that is being clamped. To ensure a good contact and to avoid this inclination to throw out it is general practice to bend the conductor into a loop or hook, or hair-pin bend, so as to embrace the terminal screw; and even then, especially when the clamping surfaces of the terminal are small compared with the conductor, the tendency is when clamping up, for the bend to open and the wire to be forced out.

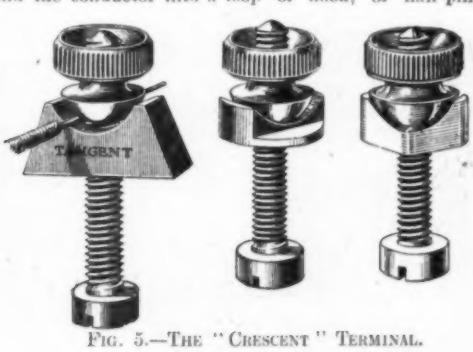


Fig. 5.—The "Crescent" Terminal.

With the "Crescent" terminal, introduced by Messrs. Gent & Co., Ltd., Faraday Works, Leicester, the tendency is to force the conductor further in and nearer to the central screw, the more the clamping surfaces are forced together by tightening. In this terminal the underside of the usual milled nut is made dome shaped instead of flat, and the dome is arranged to descend into a channel of the same radius formed in the body of the terminal. So sure is the "in thrust" that it is not necessary to loop the wire to be held; a straight wire can be clamped electrically and mechanically secure with ordinary thumb and finger twist. Pliers are not necessary. Several terminals with protuberances on the bottom plate, to prevent the conductor being thrown out, are in existence, but the "Crescent" has a further advantage that, however fine the wire to be clamped is the tendency is still to force it inwards. The terminals will grip fine wires even down to 40 s.w.g. They will also grip a straight wire or bar of metal. They will grip flexible securely without crushing it, or a stranded cable up to any diameter that will enter the jaws. They are not loosened by vibration and will not throw out the wire that is being clamped, whether straight or hooked. Fig. 5 illustrates the device.

New "Heatrae" Fires.

Electric Fires, Ltd., King Street, Norwich, has placed two new designs of fires on the market, the principal feature of

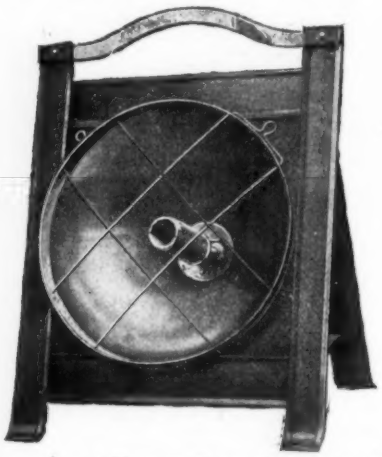


Fig. 6.—The "Heatrae Tropic" Electric Fire.

which is the element which, being plugged into a holder, is easily replaceable. One of the fires, the "Heatrae Tropic," is illustrated in fig. 6. It has a polished copper bowl fitted in a framework of ebonite black, with polished brass relief. The "Heatrae Hotspur" is similar, but instead of being mounted in a rectangular framework, the bowl is provided with a simple standing arrangement. The loading of the element in each case is 600 W.

Flame-proof Mine Motors.

Our recent review of the progress of electricity in the coal-mining industry has, no doubt, stimulated interest in the

Fig. 7.—A Flame-proof A.C. Mine Motor.

question of electrical equipment for the purpose. In this connection the English Electric Co., Ltd., Queen's House, Kingsway, W.C.2, has recently issued a publication dealing with flame-proof motors. The motor illustrated in fig. 7 is a typical example from the catalogue. It is an a.c. motor fitted with a flame-proof extension to the casing for the slip rings. All joints in the enclosure are made by wide machined flanges, which prevent the emission of flame from the machine and are preferable to labyrinth or plate protection owing to the risk of the openings involved in these methods becoming choked with dust or dirt. None of the tapped holes passes right through the casing and so the inadvertent omission of a bolt will not destroy the effectiveness of the protection. A satisfactory feature of the construction is the use of roller bearings, which permit the maintenance of a small air gap and are virtually free from wear over a period of many years. The bearings have a special ball location bearing at one end to resist thrust in either direction. They are completely enclosed in dust-proof housings, which are entirely self-contained, so that it is possible to remove the end-shields or the rotating member without exposing the bearing itself to grit or dust.

REVIEWS.

Printing Telegraph Systems and Mechanisms. By H. H. Harrison, A.M.I.E.E. Pp. xii+435; figs. 420. London: Longmans, Green & Co. Price 21s. net.

This book is intended to provide the designers of telegraph machinery with a comprehensive work of reference, and also to supply the officials of telegraph administrations with a text-book of printing telegraphs from the inception of the art down to its most recent developments.

In all there are seven chapters devoted to the subject, of which the first is of an introductory nature, partly historical and partly descriptive of the earlier systems; and the question of the design of a suitable alphabet which will give the maximum number of signals for the minimum number of constituents per signal is fully discussed. In this connection it is interesting to learn that the five-unit code of Baudot was employed by Lord Bacon in 1605 for cryptographic purposes. A hundred years hence, when the theory of relativity is better understood and appreciated than it is to-day, a reader referring to page 4 of this work will probably smile when he reads of the conversion of *space* signals into *time* signals and *vice versa*!

In Chapter II the author deals with the questions of type printing mechanisms in so far as gearing, escapements, clutches, governors, trains, motors, &c., are concerned, and gives, where he thinks it necessary, the algebraic formulæ connected with the motion of the particular piece of mechanism he is describing.

In Chapter III descriptions are given of the printer used for stock or bulletin purposes, and in this connection it is suggested that the distribution of news to small unimportant newspaper offices may in the future be effected by using this type of printer in conjunction with fast-speed YQ circuits using the five-unit code. An outline is given of the transposer method, by means of which this may be accomplished.

Chapter IV is devoted to the Hughes system. Many of the diagrams given will be familiar to the reader who has had access to the Technical Instruction of the British Post Office, or to the work by Crotch on the Hughes system. Reference is made to the modifications by Picard and Battaglia. It is, however, somewhat surprising, in view of the rapid expansion of the Baudot and other multiplex systems, to read that the Hughes is likely to hold its own for many years to come. No duplex Hughes circuits are worked in this country and the majority of the circuits worked by the Hughes apparatus have been superseded by systems which can deal far more expeditiously with telegraph traffic.

Chapter V is a long one, and deals with the various types of keyboard and keyboard transmitters, collectors, distributors, storage relays, mechanical and electrical selection, tape-controlled translators, &c., while the method by which Creed first solved the problem of reproducing Wheatstone punched slip at the receiving end of a circuit is well described and illustrated.

On page 201 the author, in describing the action of the correcting current on the Baudot distributor, says: "The brushes are not 'stepped back' on correction, they are merely stopped." On referring to Poulaine and Faivre's standard work on the Baudot we find that these authors say: "Comme le disque BB est solidaire de l'axe qui entraine les bras porte-balais, on comprend que ceux-ci se trouvent ainsi retardés, en ce sens que pendant un temps très court ils sont animés d'un mouvement moins rapide." Presumably the author's "stopped" is not to be taken literally, otherwise the inertia of a moving or stationary mass can have no significance. There is such a quantity as $mv^2/2$ and this quantity cannot "momentarily" be dissipated and re-established to its former kinetic value without something happening to "m"!—that is, if Mr. Harrison's statement be correct.

On page 292 it is stated that "leakance has the effect of reducing the transmission speed on land lines." This is not the general belief amongst telegraph engineers, and Heaviside (Advanced Electrical Papers) shows that if sufficient strength

of current is received for signalling purposes the signals can be far more distinct and rapid (with leakance) than with perfect insulation.

Chapters VI and VII deal, *inter alia*, with the Gulstad relay synchronism, single operator single channel systems, automatic systems, carrier wave circuits, automatic systems, radio *versus* wire transmission, Murray, Western Union, and Western Electric Systems, &c. It is interesting to learn that the suggestion of Marris (late of the British Post Office) as to the possibilities of wired wireless for printing telegraphs is now materialising in the research branch of the American Telegraph and Telephone Co., and that great developments are anticipated in this direction. It is doubtless quite unintentional on the author's part, but we think he has not given sufficient prominence to the fact that the very great development in multiplex printing telegraphs within the last few years is due to the British Post Office engineers, who were able, by the method of duplexing introduced by Mr. A. C. Booth, to provide Baudot multiplex sets giving 6, 8 and 12 channels where France had only 3, 4 and 6 channels. Without this stimulus it is unlikely that multiplex would have made any appreciable headway outside France, where it had been in use for some forty years. The use of the duplex multiplex has extended that system to a far greater extent than the simplex multiplex has been extended, in a very much shorter period, and it is still being extended.

The following errors, typographical and otherwise, should be noted: Page 63, $2\pi\sqrt{m/\kappa}$ should be $2\pi\sqrt{m/k}$; page 281, the value of A in equation (6) does not represent the value it should assume if equation (4) of page 279 be modified in the manner suggested; page 282, the right-hand member of equation (3) is wrong; page 292, the bracketed quantity ($RG+p^2LC$) of equation (1) should be ($RG-p^2LC$).

On the whole this volume will prove of great use to those for whom it is specifically written, and not only so because of the excellent diagrams which accompany the letterpress, but because of its providing a very complete history of the evolution of printing telegraphs since their inception. As an introduction to the main principles underlying the various systems nothing like it has yet appeared, and the standard which it has established, while it may be emulated, is hardly likely to be excelled.

Modern Electro-Plating. By W. E. Hughes, M.A. (Cantab.), D.I.C. (London), M.Inst.Met. Pp. vii+160; figs. 30. London: Henry Frowde and Hodder & Stoughton. Price 16s. net.

The greater part of this book was originally published as a series of articles in the pages of *Beama*. This volume forms a useful manual for students and a highly practical guide book for those engaged in the electro-plating industry. The book is well and clearly written, but is condensed in parts, which is due to the limitation of the volume.

The first section of the book gives a general review of modern electro-plating from the theoretical and practical standpoints, and an endeavour has been made to correlate the methods of treatment with the scientific principles on which these methods are based. The second section sketches in a general way the workshop practice in the deposition and electro-plating of metals, and the third, which is by far the most valuable, describes the deposition and finishing processes connected with the electro-metallurgy and more particularly the electro-plating of iron, nickel, zinc, lead, tin, chromium and copper.

It is to be regretted that in a standard work of this kind no place was found for a study of silver electro-plating, which is of first-rate importance in the industry. In a foreword to the book the author pleads that the economy of space would not permit of the including of silver electro-plating.

Pages 144/146 consists of advice on what to read in connection with the subject, and also lists of English and foreign periodicals and textbooks, which are of interest to those connected with the electro-plating industry.

A feature of the book is the highly valuable references to original technical literature and patent specifications on the subject, which appear as footnotes and at the end of each chapter.

Some of the tables at the end of the book are quite unnecessary in a volume of this kind, as they can be found in any standard book of tables; for example, page 148 is a comparison of thermometric scales; p. 149/150 comparative table of hydrometer degrees, Beaumé and Twaddle: p. 151/153 tables of specific gravities of aqueous solutions of sulphuric acid and nitric acid respectively.

The volume contains a considerable amount of information which is of practical value to those engaged in work connected with the depositing of metals, as much of the matter is the outcome of the author's own practical experience as chief research chemist to the Electro-Metallurgical Committee of the Ministry of Munitions and elsewhere.

The book is written in a clear and interesting manner, and although intended specially as a "guide book for platers, works chemists, and engineers," the volume can be recommended to all concerned with the electro-deposition of metals, and to all who require a concise and up-to-date summary of information on the subject.

It contains 18 plates, mainly reproduced from photographs; those illustrating the examination under the microscope of electro-deposited metal are particularly good. The reference to literature at the end of each chapter and in the form of footnotes might well be enlarged and given as a complete bibliography, which would have added to the value of the book.

The book is well printed and reference must be made to the numerous and excellent illustrations. The volume presents in a convenient form the information at present available on the subject, and is a welcome addition to the series of Oxford Technical Publications.

Wireless Facts and Figures. By A. V. Ballhatchet, M.Inst.J.E. Pp. 52; figs. 15. London: Percival Marshall and Co. Price 6d. net.

This is a collection of data, formulæ, and practical hints, which should be of considerable value to the amateur experimenter in radio reception. The experimenter who has little time or inclination to search in the text-books for the data which he requires for winding coils, making up condensers, &c., for his experiments would be well advised to get this little book.

Wireless of To-day. By C. R. Gibson, F.R.S.E., and W. B. Cole, A.M.I.E.E. Pp. 318; figs. 38. Illustrated. London: Seeley, Service & Co. Price 7s. 6d. net.

Since the advent of wireless broadcasting in this country just over a year ago, writers, publishers, reviewers, and, let us hope, other readers, have been struggling with a great mass of books on wireless signalling, 80 per cent. of which consists mainly of explanations of receiving circuits. This book is happily amongst those of the remaining 20 per cent., and covers much ground not touched on in any of them. Mr. Gibson is an old hand at what is called popular science. He knows well how to interest a non-technical reader in a scientific subject, and, with Mr. Cole's specialised assistance, he succeeds here as he has so often succeeded before. But the book will not only interest the layman, it will appeal also to the technician familiar with other branches of electrical science, and even, as a book of reference on historical facts, to professional wireless workers, particularly to those whose chief wireless work is apparently performed with a pen, and who will welcome the excellent index provided.

The book gives the history, the fundamental principles, and the present application of wireless telegraphy and telephony in a simple, accurate, and interesting manner.

The historical portions are particularly good, but if one were forced to criticise one might ask for less of Sir William Preece, and more, as there is nothing, of Admiral Jackson; all of what the former did has been fully published, whereas most of what the latter did was behind the veil of the Silent Service.

We know of no other book which gives in so interesting a manner such an accurate historical sketch of the development of wireless signalling.

The other portions of the book are less complete, though accurate and up to date; but in the chapter on calling devices, as in some other parts also, the apparatus of companies other than the Marconi Co. might have been included with advantage. In a book so well written, the use of the word "broadcasted" comes as rather a shock.

Introduction to Wireless Telegraphy and Telephony. By J. A. Fleming, M.A., D.Sc., F.R.S. Pp. xi+112; figs. 65. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d. net.

This book is a concise and accurate outline of the principles and application of the transmission and reception of wireless telegraphy and telephony, and is suitable for readers who possess at least an elementary knowledge of electrical phenomena. Dr. Fleming is careful to confine himself to a short non-mathematical description of fundamental principles and their up-to-date application, with the result that the reader will find an amazing amount of information packed into the 109 pages. All explanations are as concise as is compatible with clarity, and the illustrations, printing, and general "get up" are excellent.

No better introduction could be placed before those who intend to pursue a serious study of the subject.

Successful Wireless Reception. By Paul D. Tyers. Pp. 87; figs. 48. London: Percival Marshall & Co. Price 1s. 6d. net.

This book will help the beginner, be he "listener" or experimenter, to choose suitable instruments and use them to the best advantage. The first 34 pages deal with the manipulation of commercial broadcast receivers, the remainder of the book being devoted to sets made up of assembled apparatus. There are many "listeners," and there will soon be many more, who have no interest in the technique of radio signalling, but who do wish to get the best results out of their broadcast receivers. These will welcome Part 1, and after a spell of pure "listening," the majority will be into Part 2 on the high road to join forces with their experimental friends. Mr. Tyers, in fact, baits his hook in Part 1 for the fish to be caught in Part 2.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C. 1.
The name of the applicant's patent agent, if any, will be found on the printed specification.

30,907. "Electric welding, &c." Soc. Alsacienne de Constructions Mécaniques. December 8th. (France, December 8th, 1922.)
30,918. "Electric storage batteries." J. F. Monnot. December 8th.
30,923. "Connection for electric dry batteries." C. J. Werts. December 8th.
30,925. "Wireless receiving apparatus." T. Quinney. December 8th.
30,939. "Non-metallic resistance for electric heating, &c." S. W. Wilding. December 10th.
30,943. "Lamps for motor-cars, &c." E. L. Pessell and R. C. Pessell. December 10th.
30,969. "Variable speed induction motor." R. D. Ball. December 10th.
30,974. "Electric switches." H. W. Cox. December 10th.
30,975. "Variable electric condensers." H. O. Wallis. December 10th.
30,994. "Current-collectors for electric power distribution." V. Primett. December 10th.
31,006. "Loud speakers for radio telephonic apparatus." F. J. Cripwell. December 10th.
31,015. "Electrolytic apparatus." J. P. Scott. December 10th.
31,030. "Loud-speaking telephone station." Soc. des Etablissements Gaumont. December 10th. (Belgium, January 27th.)
31,032. "Electromagnets." F. W. Leake, and Tyer & Co., Ltd. December 10th.
31,035. "Wireless receiving systems, &c." J. Scott-Taggart. December 10th.
31,036. "Wireless receivers, &c." J. Scott-Taggart. December 10th.
31,038. "Detachable electric couplings, &c." J. Etchells and Vickers, Ltd. December 10th.
31,055. "Electric bell push." J. W. Cathles and M. L. Cathles. December 11th.
31,079. "Wires or cables for wireless aerials, &c." E. E. Makinson. December 11th.
31,085. "Electrically-driven spindle for textile machines." P. A. H. Mossay and J. B. White. December 11th.
31,091. "Luminous electric heaters." Falkirk Iron Co., Ltd., and A. R. Wood. December 11th.
31,106. "Electric relays." J. Piquet and A. Reyrolle & Co., Ltd. December 11th.
31,107. "Electric plug and socket connections." W. A. Harriman and A. Reyrolle & Co., Ltd. December 11th.
31,111. "Balancing of telegraph cables or lines." B. Davies, E. S. Heartley, and Muirhead & Co., Ltd. December 11th.
31,116. "Magnetic alloys, and their application for manufacture of telegraphic, &c., cables." H. J. Garnett and W. S. Smith. December 11th.
31,117. "Variable resistances." Soc. Belge Radio-Electrique. December 11th. (Belgium, December 18th, 1922.)
31,119. "Illuminated sign." C. R. Belling, Belling & Lee, Ltd., and E. M. Lee. December 11th.
31,120. "Mercury vapour lamps." Hewittic Electric Co., Ltd. (Westinghouse Cooper Hewitt Ges.). December 11th.
31,127. "Plate condensers, &c." Coke & Gas Ovens, Ltd. (Still). December 11th.
31,130. "Electric relays." Metropolitan-Vickers Electrical Co., Ltd., T. W. Ross, and C. Ryder. December 11th.
31,131. "Electric synchronising-apparatus." Metropolitan-Vickers Electrical Co., Ltd., T. W. Ross, and A. F. Thompson. December 11th.
31,133. "Terminals." F. S. S. Wates. December 11th.
31,140. "Reception of wireless, &c., signals." J. Hettinger and C. A. Vandervell. December 11th.
31,141. "Electric condensers." Cambridge & Paul Instrument Co., Ltd., and W. H. Lawes. December 11th.
31,165. "Electric lamps." A. G. Westmoreland and S. Wiseman. December 11th.
31,166. "Telephone receiver, &c., supports." E. Hayward. December 11th.
31,174. "Wireless receiving circuit." W. E. Miller. December 12th.
31,175. "Thermionic valve, &c." W. E. Miller. December 12th.
31,180. "Inductance coils." H. Ingham. December 12th.
31,181. "Wireless receiving apparatus." H. S. Cooke and Cooke & Whitfield Wireless, Ltd. December 12th.
31,207. "Commutators for engine ignition systems." W. Barclay. December 12th.
31,223. "Electric connectors." W. T. Glover & Co., Ltd., and F. C. Raphael. December 12th.
31,224. "Means for binding metal-covered cables to electric junction boxes." W. T. Glover & Co., Ltd., and F. C. Raphael. December 12th.
31,238. "Electric lamp shades." J. Mersing. December 12th.
31,244. "Self-winding electric clocks." Embe-Fahrzeug-Uhren Ges. December 12th. (Germany, December 14th, 1922.)
31,248. "Thermionic valves." Edison Swan Electric Co., Ltd., and T. W. Price. December 12th.
31,254. "Röntgen tubes, &c." Reiniger Gebbert & Schall Akt. Ges. December 12th. (Germany, June 20th.)
31,259. "Fuse-supporting plugs." H. C. J. Burnham. December 12th.
31,260. "Telephone systems and apparatus." Automatic Telephone Manufacturing Co., Ltd. December 12th.
31,272. "Electrically-operated speedometers." A. M. Cox. December 12th.
31,275. "Protective arrangements for electrical installations." U. Modigliani. December 12th. (Germany, December 13th, 1922.)
31,292. "Grid leaks for valves of wireless apparatus, &c." E. G. Phillips. December 13th.
31,304. "Wireless apparatus." A. P. C. Collier. December 13th.
31,309. "Crystal detector." J. S. Elder and L. S. Elder. December 13th.
31,322. "Multi-contact switches." B. Thomas and E. Thomas. December 13th.
31,326. "Electric plug-and-socket connections." A. Reyrolle & Co., Ltd., and H. F. Secretan. December 13th.
31,334. "Electric temperature indicators." J. R. Coltman and C. E. Parr. December 13th.
31,337. "Socket connector for electric circuits." K. N. Arnold. December 13th.
31,345. "Sparking plugs." Soc. Anon. Etablissements Industriels, J. A. M. December 13th. (France, December 16th, 1922.)
31,358. "System of traction by heat motor and electric transmission." Forges et Ateliers de Constructions Electriques de Jeumont. December 13th. (France, January 8th.)
31,366. "Aerials for wireless telegraphy, &c." H. W. Bullock and Wilbarton & Co., Ltd. December 13th.
31,371. "Holders for valves of wireless apparatus." R. Woods. December 13th.
31,388. "Magneto-electric machines." A. Massey-Allen and R. B. North. December 13th.
31,392. "Electric furnace." B. M. S. Kalling. December 13th.
31,408. "Wireless telephones." C. M. Hutton. December 14th.
31,421. "Diaphragms for sound-recording, &c., devices." W. E. Clifton and Cliftophone, Ltd. December 14th.
31,449. "Electrically-operated speed indicators." A. M. Cox. December 14th.
31,463. "Magneto mounting for internal-combustion engines." Normand Garage, Ltd., and H. D. Smith. December 14th.
31,465. "Electric ignition devices for explosion engines." G. H. M. Rasour. December 14th.
31,483. "Use of vacuum tubes." J. W. Mason and X-Rays, Ltd. December 15th.
31,486. "Telephone receivers, &c." E. V. Mackintosh. December 15th.
31,490. "Terminals for telephone receivers, &c." E. A. Poyser and D. R. Poyser. December 15th.
31,496. "Ear piece for telephones, &c." A. Hopkinson. December 15th.
31,497. "Electric condensers." W. H. Gaskell and A. F. Holliday. December 15th.
31,503. "Electric switch." E. P. Chapman and S. A. Chapman. December 15th.
31,509. "Detectors for wireless telegraphy, &c." S. Crosby and F. W. Durrant. December 15th.
31,519. "Electric switch." M. Semple. December 15th.
31,544. "Electromagnetically actuated valves." Nederlandsche Gisten Spiritusfabriek. December 15th. (Holland, December 20th, 1922.)
31,549. "Method of connecting wireless components." C. R. Lown. December 15th.
31,553. "Preparation of active material for electric storage batteries." J. F. Monnot. December 15th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

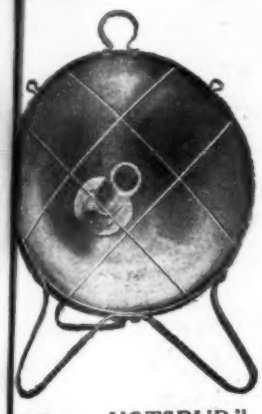
1922.

15,132. "Device for locking electric lamp globes in their holders." A. Wilkinson, Junr., and Wilkinsons (Liverpool), Ltd. May 30th, 1922. (Cognate application 20,493/22.) (207,565.)
17,577. "Method of diminishing the risk of back ignition in series-connected electric rectifiers." Akt. Ges. Brown, Boveri et Cie. July 2nd, 1921. (182,402.)
20,188. "Submarine cable-handling machinery." F. E. Pernot. July 24th, 1922. (207,574.)
20,908. "Storage-battery systems." A. E. White (Cellokay Manufacturing Corporation). July 31st, 1922. (207,578.)
20,930. "Apparatus for electrically enabling bodies to follow a marked-out route." Soc. Industrielle des Procédés W. A. Loth. July 29th, 1921. (183,861.)
21,163. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 7th, 1921. (185,723.)
22,572. "Electric signalling devices." E. I. David, G. F. Flanders, and D. S. Williams. August 18th, 1922. (207,586.)
23,447. "Manufacture of electric storage-battery plates." W. J. Plews. August 29th, 1922. (207,606.)
23,656. "Automatic telephone system and switching apparatus therefor." H. Baron (F. Aldendorff). August 31st, 1922. (207,613.)
23,977. "Electrolytic gas-generating systems." J. P. Scott. September 4th, 1922. (207,630.)
24,298. "Asynchronous induction motors." T. Torda. November 22nd, 1921. (189,421.)
25,208. "Electrical condensers and the like." W. J. Brown, H. G. Bell, and Metropolitan-Vickers Electrical Co., Ltd. September 18th, 1922. (207,649.)
25,994. "Electric incandescent lamp." E. De Lorenzi. September 26th, 1922. (Patent of addition not granted.) (207,652.)
26,425. "Oscillating electric fans." A. H. Railing and A. E. Angold. September 30th, 1922. (207,655.)
27,011. "Suspension or connection device for electric fittings and the like." A. P. Rutherford and A. N. Haddow. October 6th, 1922. (207,658.)
28,592. "Measurement of X-radiations." C. E. S. Phillips. October 20th, 1922. (207,672.)
29,407. "Magnetic fluxmeters." Eastern Telegraph Co., Ltd., and B. Davies. October 27th, 1922. (207,680.)
30,154. "Automatic cut-out devices for electrical circuits." Soc. Drault and Raulot Lapointe. December 22nd, 1921. (190,703.)
31,240. "Electrical impulse distributing systems." Western Electric Co., Ltd. January 13th, 1922. (191,707.)
32,257. "Relay for automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. C. Puckette. November 25th, 1922. (207,697.)
33,886. "High-frequency electric installations." G. A. Beauvais. December 12th, 1921. (Addition to 131,018.) (190,177.)

1923.

517. "Wireless receiving circuits." W. Diggle. January 6th, 1923. (207,720.)
2,657. "Telephone systems." Western Electric Co., Ltd. (G. Deakin). January 29th, 1923. (207,725.)
2,774. "Thermionic generators." Ges. für Drahtlose Telegraphie. February 14th, 1922. (193,387.)
5,134. "Wireless telephony or the like." R. W. Anstey. February 22nd, 1923. (207,736.)
7,071. "Thermionic valves." H. C. Phillips. April 13th, 1923. (207,740.)
7,631. "Multiple-core high-tension cable." Naamlooze Vennootschap Nederlandsche Kabelfabriek. March 18th, 1922. (195,085.)
8,340. "Wireless receiving apparatus." Western Electric Co., Ltd., and G. H. Nash. March 23rd, 1923. (207,746.)
8,965. "Electrically-operated compressors for refrigerating and other machines." B. Bischof and C. Haccius. April 10th, 1922 (195,961.)
16,285. "Electric discharge devices." C. H. F. Müller (firm of). June 23rd, 1922. (199,738.)

Railway Working in Norway.—During the recent discussion in the Storthing of the question of railway working one of the speakers pointed out the absurdity of constructing steam railways and then afterwards being compelled to convert them to electric traction. He therefore proposed that all future railways should be installed for electrical working from the very beginning. The proposal, however, was withdrawn after suggestions had been made that the Norwegian committee which is investigating the use of electricity on the railways in the United States should be allowed to complete its labours, before further action is taken in Norway. In this connection it is shown that very little progress has been made in electric railway work in that country down to the present time. Four lines only, of a total length of 85 miles, are electrically equipped, or only 4 per cent. of the total railway mileage in Norway. Two of the lines—Thamshavn-Lekken and the Rjukan railway—are privately owned and have been equipped since 1908-10 and 1911-12 respectively, while the State Drammen railway has been electrically operated since 1922, and the Ofot line was inaugurated in 1923.



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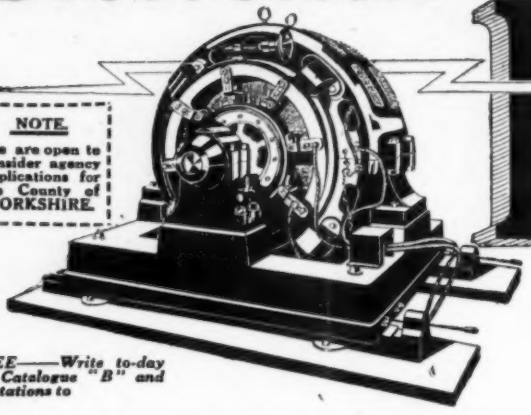

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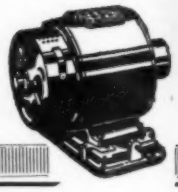

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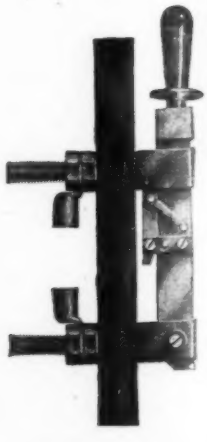

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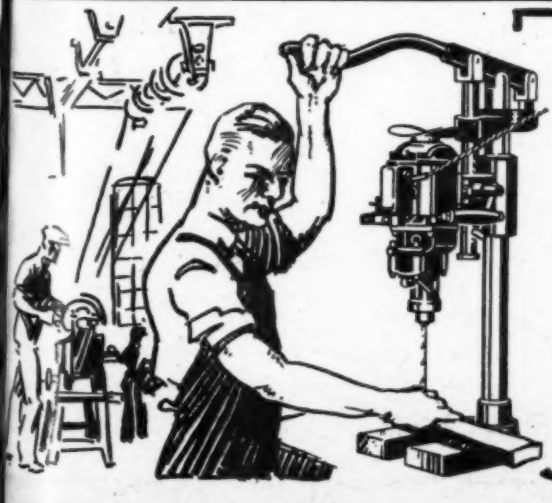

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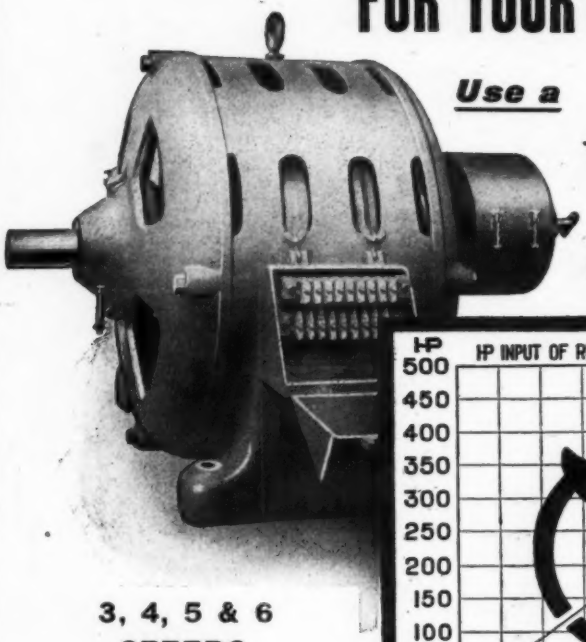

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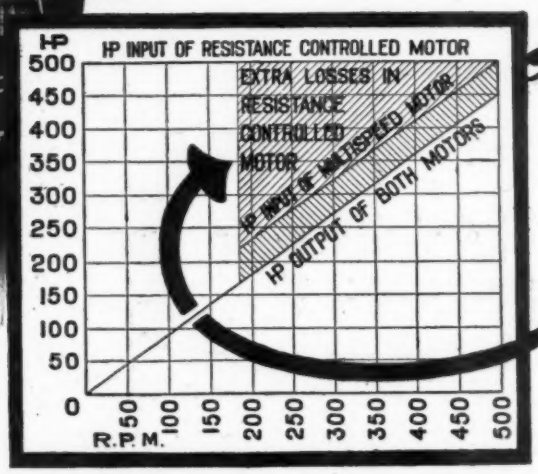

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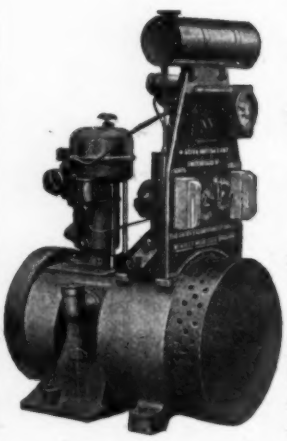

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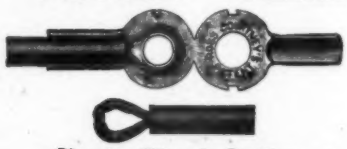

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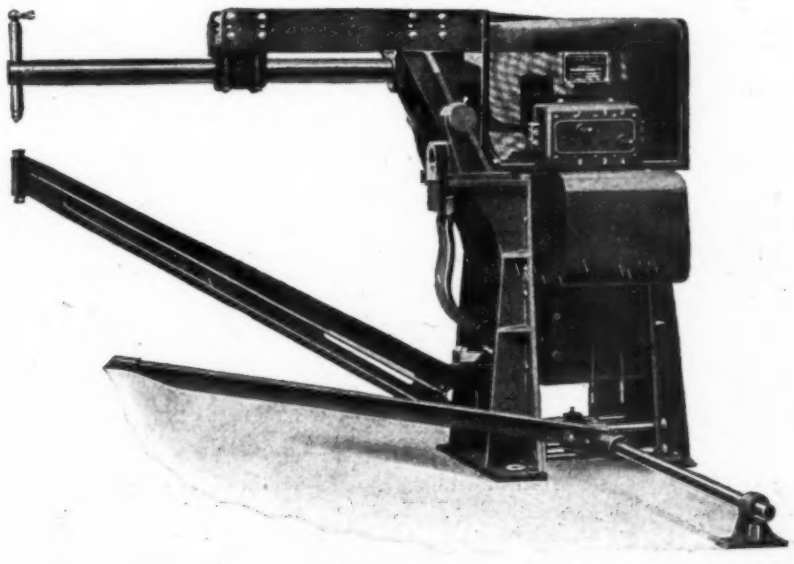

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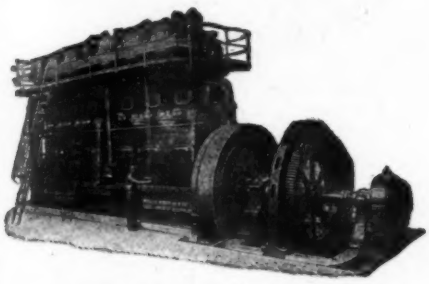

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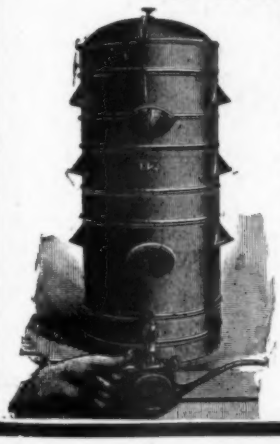

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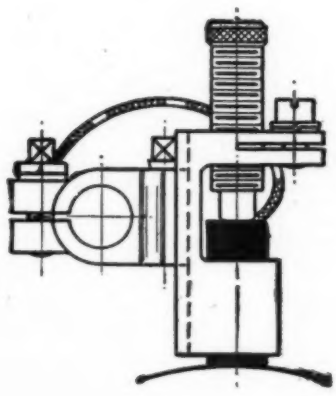

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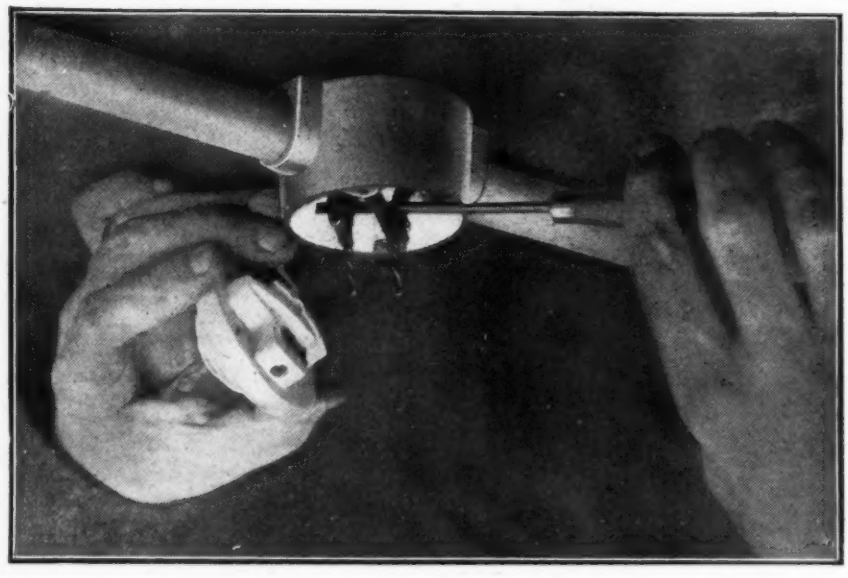

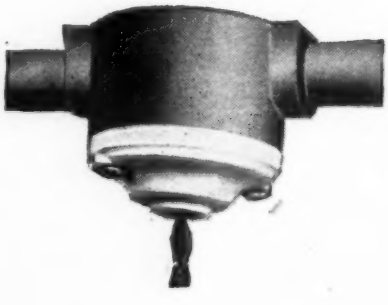

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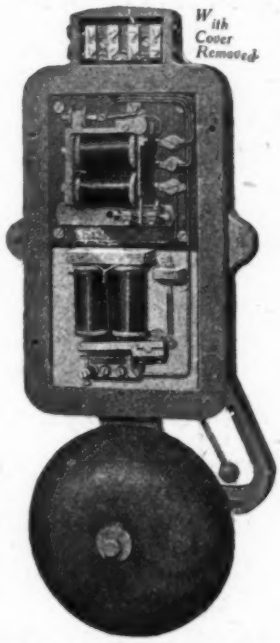

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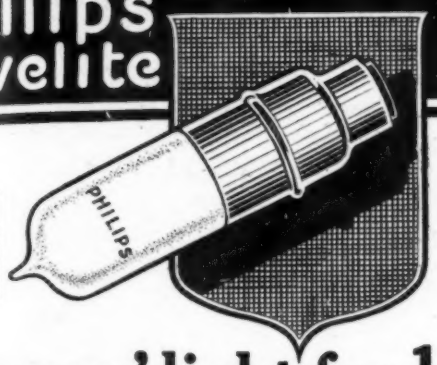

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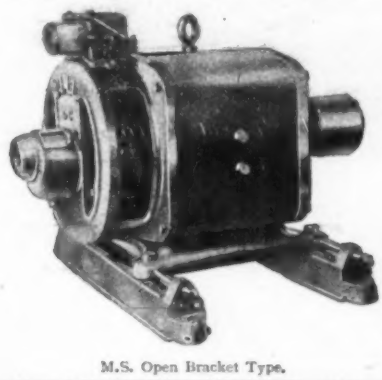

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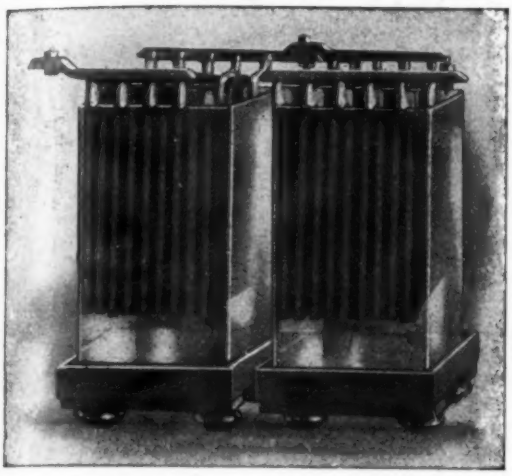

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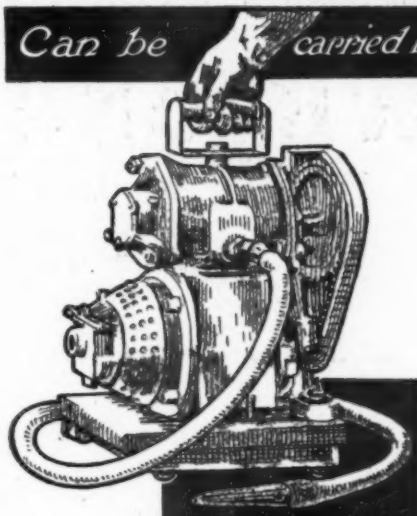

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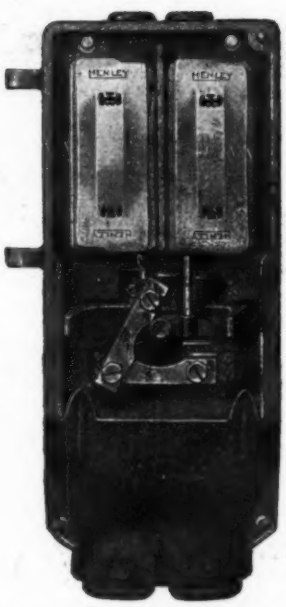

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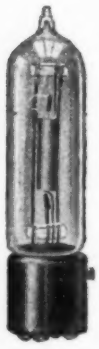

The **WECOVALVE** (Pea-nut type) can be used with your existing receiving sets by the use of the Wecovalve Adaptor (No. 44092) which has contact springs faced with gold and silver alloy to insure perfect contact with the base of the valve.

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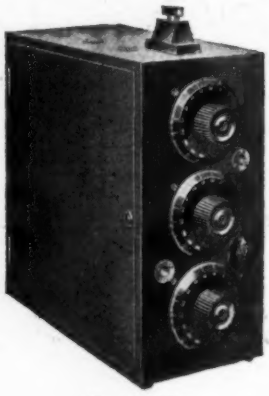

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Two Valve Receiving Set with Coil Attachments.

THIS TWO VALVE WECONOMY SET (No. 44081), fitted with Wecovalves, is arranged for high frequency amplification and detection, and is complete with tuning inductance, filament, resistance, &c., to cover the Broadcast wave length band of 300 to 500 metres. That is, it will tune to any of the B.B.C. Stations without additional coils. By adding Igranic Coils, for which two holders are provided, the tuning can be increased up to 3000 metres. The power of this Set is such that with a standard aerial it will receive B.B.C. Stations within a wide radius. This is accomplished by using a tuned anode circuit and a certain degree of reaction. The Set gives a purity of tone better than that of other reaction sets on the market, and is therefore suitable for use with Loud Speakers. Two dry cells are required for the filaments, and a 45-volt battery for the plate circuit.

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One or Two Stage Low Frequency Amplifier.

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Write for Publication No. 396
entitled
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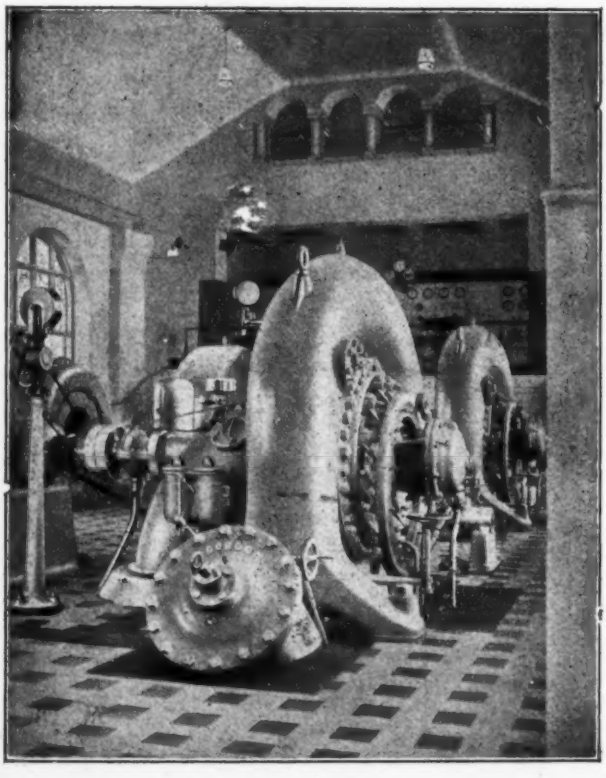

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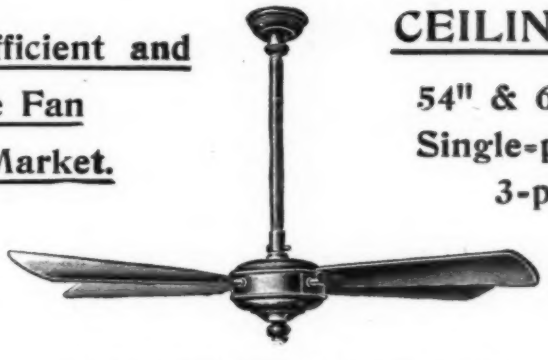

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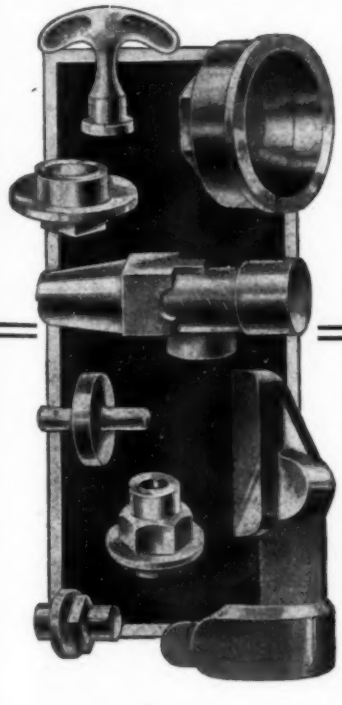

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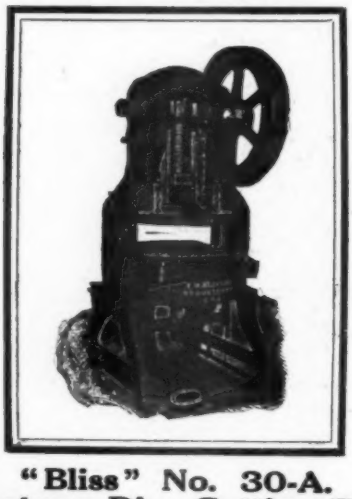

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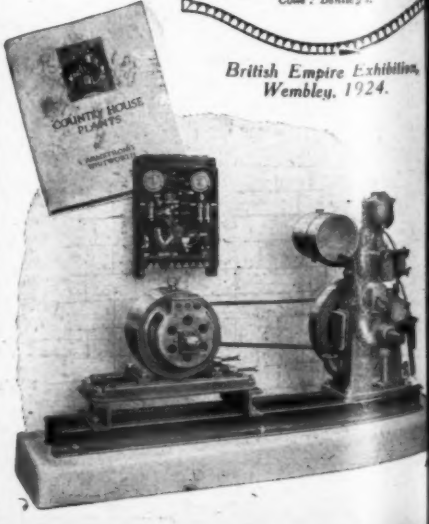

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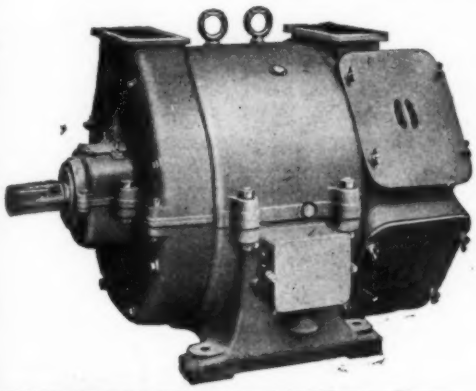

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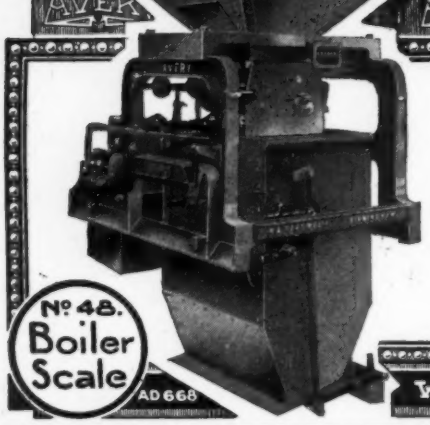

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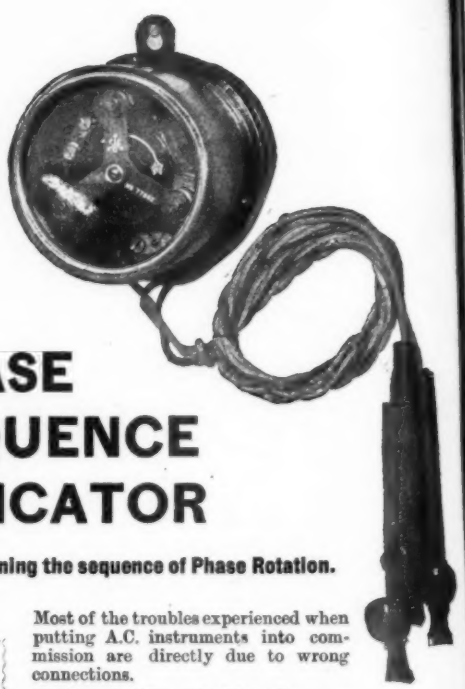

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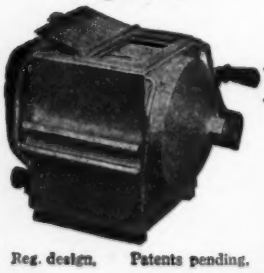

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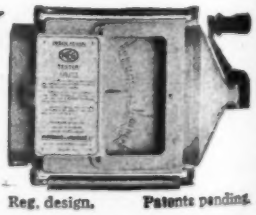

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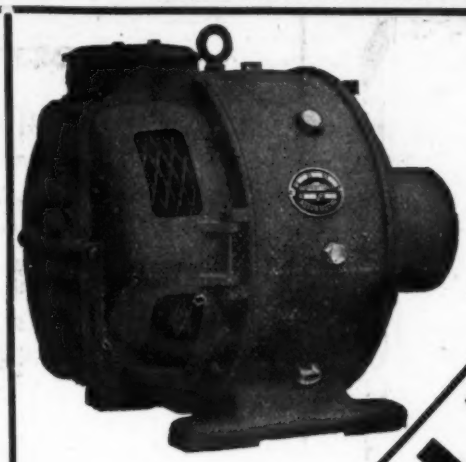

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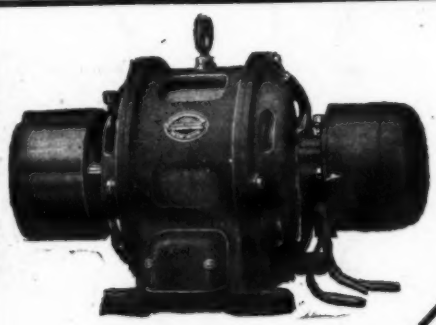

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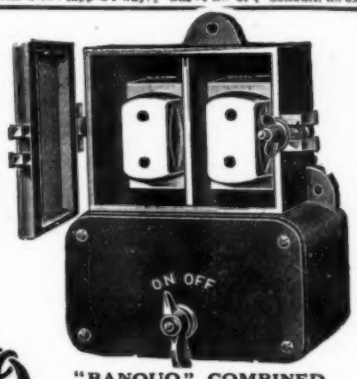

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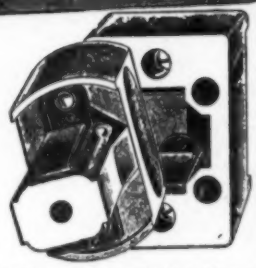

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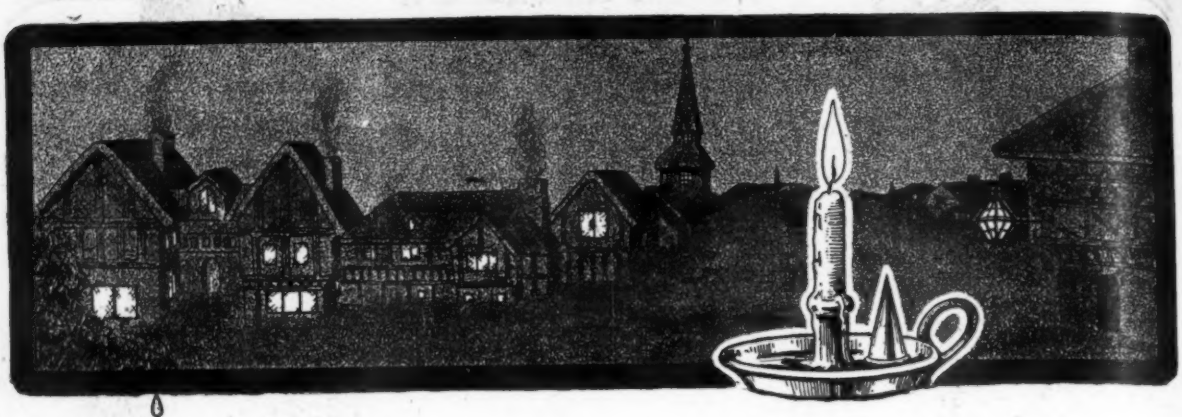


1895

The Trade Mark "CRYSELCO" is a guarantee of reliability and excellence—the result of 28 years of experience in lamp manufacture, and in purchasing lamps bearing this Trade Mark you do so without fear of action for infringement of patent, as "CRYSELCO" Lamps are fully licensed under British Patents 23499/09, 10918/13 and others.

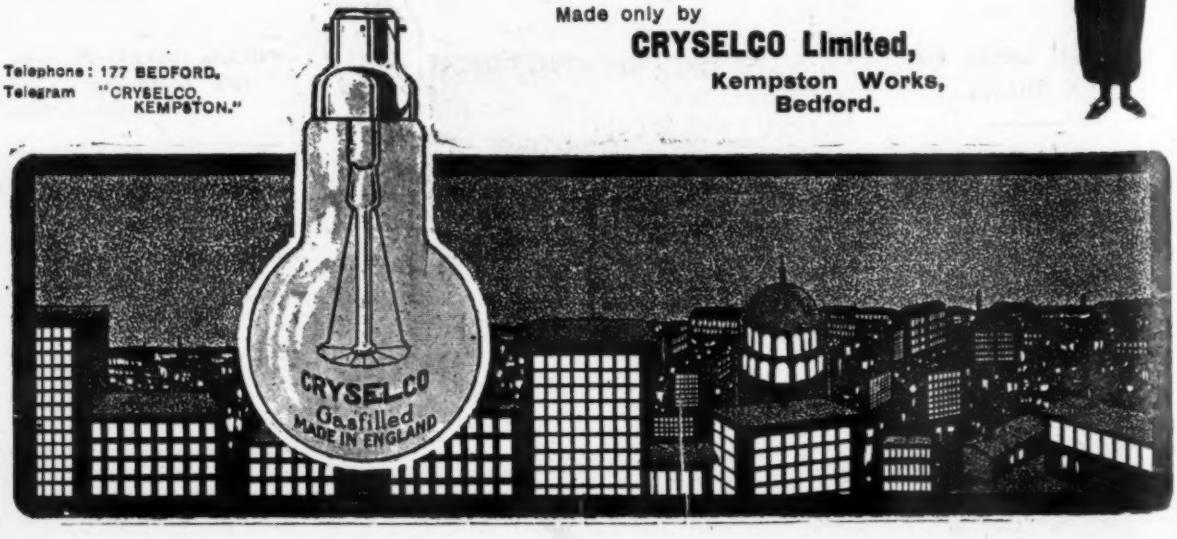
1923

CRYSELCO

ELECTRIC LAMPS.

Made only by
CRYSELCO Limited,
Kempston Works,
Bedford.

Telephone: 177 BEDFORD.
Telegram "CRYSELCO, KEMPSTON."



WIRELESS!

SPECIFY

CONNOLLYS PATENT ENAMEL

COPPER INSULATED WIRES.

The recognised foremost makers of

INSULATED WIRES AND CABLES,
ENAMELLED INSULATED WIRES,
COTTON COVERED WIRES,
SILK COVERED WIRES, &c.

Makers of the **FAMOUS BLACKLEY TAPE.**

Enquiries to :

CONNOLLYS (BLACKLEY), Ltd.,

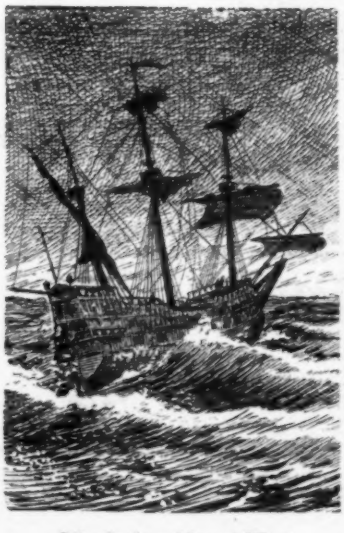
Specialists in Fine Wires,

BLACKLEY, MANCHESTER.

Telephone : Cheetham Hill 640. *Telegrams :* "Connolly," Blackley.

London Office :
53, VICTORIA STREET, S.W. 1.
Telephone : VICTORIA 3512.
Telegrams : "LIFEHOLD," Sowest, London.

The Development of an Ideal in Craftsmanship



Elizabethan Man-o'-War

AMONG the periods in the history of the world, when creative effort reached the peaks of expression, must certainly be reckoned the Elizabethan age. This glorious epoch in the Nation's history represents in creative ability a tremendous stride forward towards the higher Craftsmanship we know to-day.

* * *

The application of Electricity to every day requirements has taken only as many years in its stride as other industries have taken centuries.

For this reason all electrical research and experiment has been, and must continue to be, intensified in progressive effort to meet the needs of to-day and thus those of to-morrow.

"Craftsmen in Switches."

J.A. CRABTREE & Co. LTD

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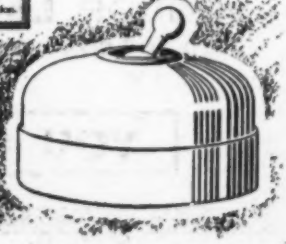
LONDON OFFICE & STORES :— Whitcomb St., W.C.2.
Phone — 7424, Gerrard. "Grams"—Brickmake-Phone London.



TRADE MARK
CRABTREE

M.G.P.

Condor
VENLO (HOLLAND)

"T.A." LAMP.

Condor
VENLO (HOLLAND)
ESTABLISHED 1889.

QUALITY

Condor
VENLO (HOLLAND)

INDEMNITY.

ALL TRADE RE-SELLERS AND USERS OF CONDOR LAMPS ARE HELD FULLY INDEMNIFIED BY US AGAINST ACTIONS FOR ALLEGED INFRINGEMENT OF PATENTS.

SPECIAL NOTICE.

WE ARE NOW AUTHORISED TO STATE THAT FOR THE PAST TWELVE MONTHS ALL CONDOR METAL FILAMENT LAMPS IMPORTED INTO GREAT BRITAIN AND IRELAND HAVE BEEN MANUFACTURED WITH DRAWN TUNGSTEN WIRE MADE UNDER SPECIAL PROCESSES WHICH ARE PROTECTED BY APPLICATIONS FOR BRITISH PATENTS.

DELIVERIES FROM STOCK.

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60, WILSON STREET, FINSBURY SQUARE. LONDON. E.C. 2.

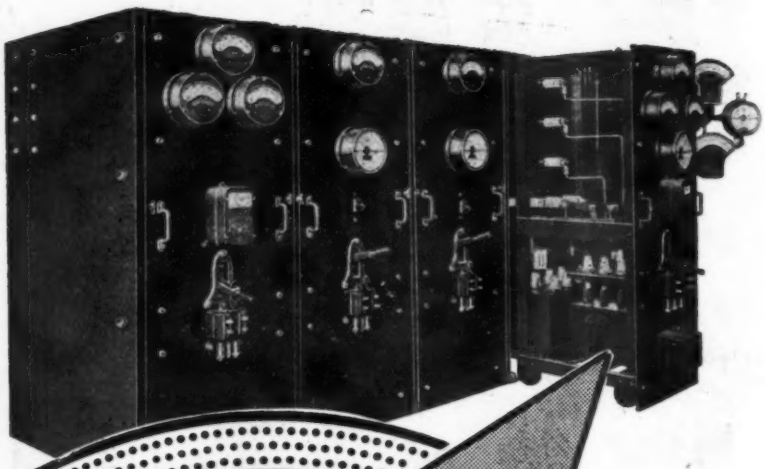
YOU CANNOT BUY A BETTER LAMP.

THE CABLE ACCESSORIES Co LTD.

TIVIDALE, TIPTON.

THERE IS A *Revo* DESIGN FOR EVERY PURPOSE SEND FOR CATALOGUE.

ONE OF THE "J.&P." PAGES



There's Safety—

When the man who knows less about the job has to deputise for the man who knows it all — THERE'S SAFETY. When the man who knows it all makes the accidental slip to which we all are prone—THERE'S SAFETY. In a word, there's no trusting to luck with a J. & P. Truck, and when repairs, replacements or adjustments have to be made, they can only be effected when the truck is withdrawn, which action renders all "live" parts dead. The Board illustrated is a J. & P. Truck type, comprising four truck panels and one stationary panel for automatic pressure regulator for 6,000-volt 3-phase system. And we have interesting Booklets describing others. Will you ask for copies?

Johnson & Phillips, Ltd.,

Specialists in the Transmission, Transformation and Distribution of Electricity,

CHARLTON, LONDON, S.E.7.

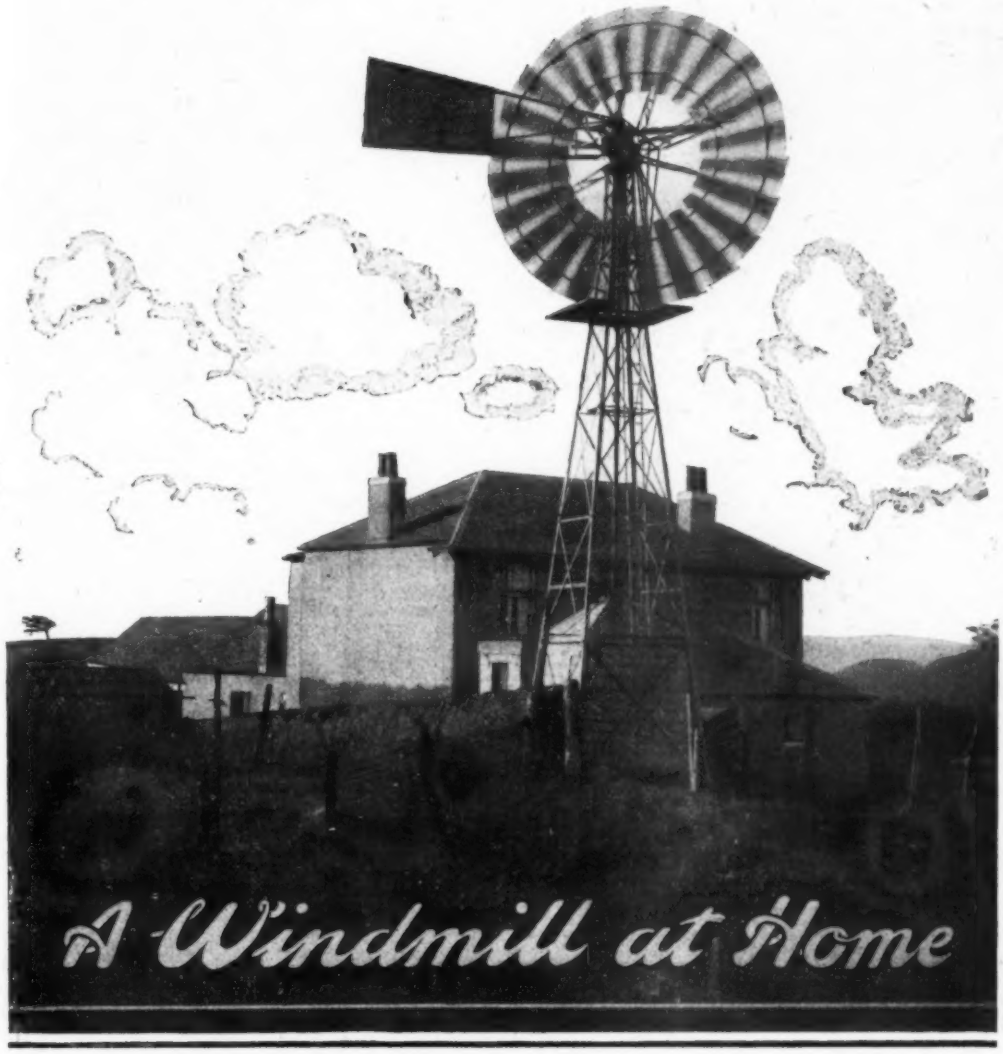
City Office and Stores—

12, Union Court, Old Broad Street, E.C.2.

Depot and Branches at BIRMINGHAM—224, Corporation Street. CARDIFF—2a, Court Road, BRISTOL—1, Nelson Street. GLASGOW—159, West George Street. LIVERPOOL—57, The Albany. MANCHESTER—251, Deansgate. NEWCASTLE-ON-TYNE—43b, Blackett Street. PORTSMOUTH—5, Sussex Street. BELFAST—44, Upper Arthur Street. SYDNEY—206, Clarence Street (N.S.W.), and at MELBOURNE.

THE MARK THAT MEANS ... THAT LITTLE MORE IN QUALITY

ONE OF THE "J.&P." PAGES



A Windmill at Home

We have poked fun at the Fleet Street vision of abandoning coal as our prime source of energy and covering the country with Windmills instead.

But in so doing we were careful to mention that the wind engine had its legitimate sphere, and here is one in it.

This windmill plant was erected by Messrs. D. & J. Gilmour, 187, St. Vincent Street, Glasgow, for Duncan Currie, Esq., Crossbeag, Rothesay, Bute. The 50-volt dynamo supplies some 36 lighting and 6 heating points, and a battery is provided as a standby.

On that western isle suitable fuel is scarce and dear, but seldom is there a day when the wind fails:

"There leaps ashore the full South West
All heavy-winged with brine."

Its persistence and pressure may be guessed from the shape of the lonely leaning tree on the horizon. It will be seen from the picture that the wheel did not stop to pose for its photograph.

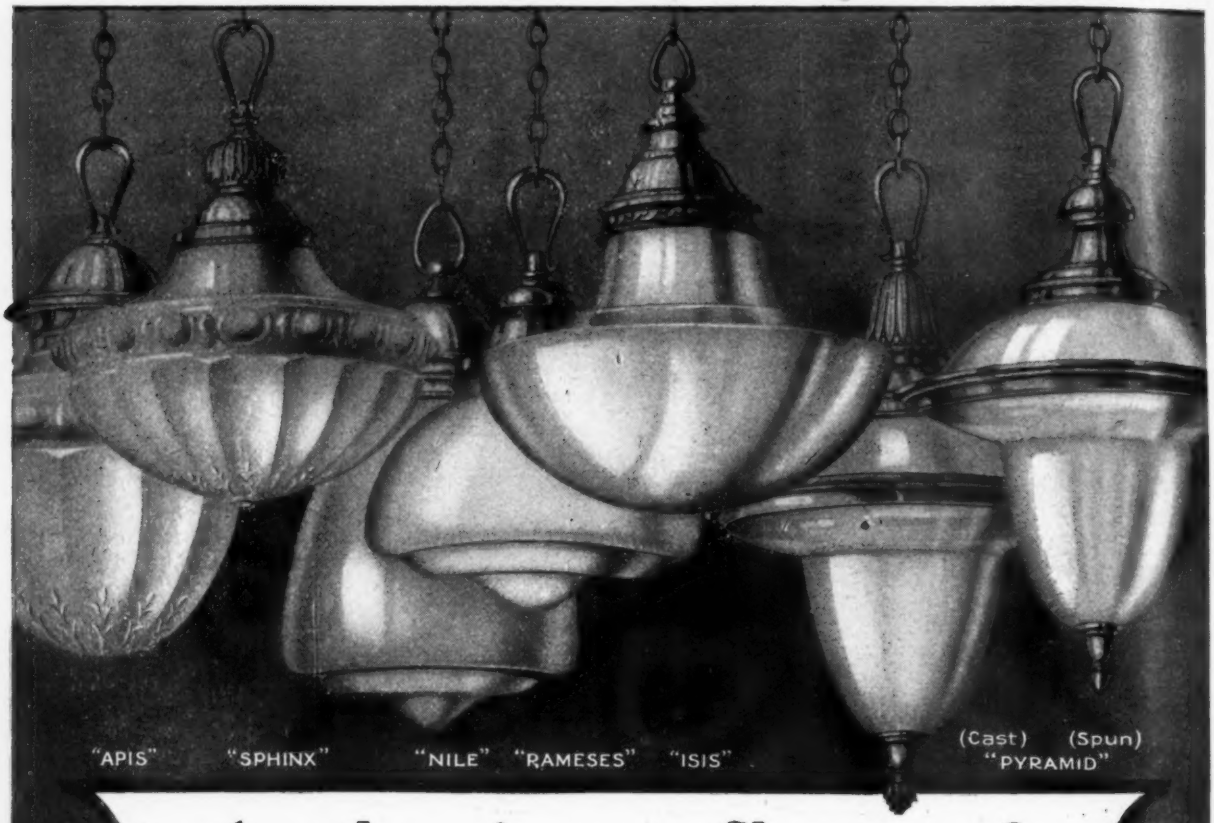
The best cable was naturally used for the wiring—J. & P. V.I.R. cable run in steel tubing.

JOHNSON & PHILLIPS, LTD., CHARLTON, LONDON, S.E. 7.

City Office & Stores - - 12, Union Court, Old Broad Street, E.C.2.

THE MARK THAT MEANS THAT LITTLE MORE IN QUALITY

Cosmos Dust-proof, one-piece units.



"APIS" "SPHINX" "NILE" "RAMESES" "ISIS" (Cast) (Spun) "PYRAMID"

Are these in your Showrooms?

The Booklet reproduced below consists of 20 pages, with an attractive cover in colour. It gives details and prices of "COSMOS" Dust-proof, One-piece Lighting Units. These booklets are now available for over-printing with YOUR NAME AND ADDRESS.

Send for specimen copy V. 4128/2.

WE have pleasure in announcing that we have large stocks of "COSMOS" DUST-PROOF, ONE-PIECE UNITS, comprising "Moonstone," "Sol-lux" and "Commercial Units," now available at our Showrooms and Stores throughout the country. We are consequently in a position to offer, to Factors and Contractors, complete Lighting Fittings ***from stock*** as cheaply as could be obtained if the metal and glass parts were bought separately. Our aim is to give to the trade ***prompt*** and efficient service. You are asked to make use of our Showroom in your district, as if it was an extension of your own premises.

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BIRMINGHAM
BRISTOL
CARDIFF
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EDINBURGH
GLASGOW
SOUTHAMPTON
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MANCHESTER
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SHEFFIELD
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M 04

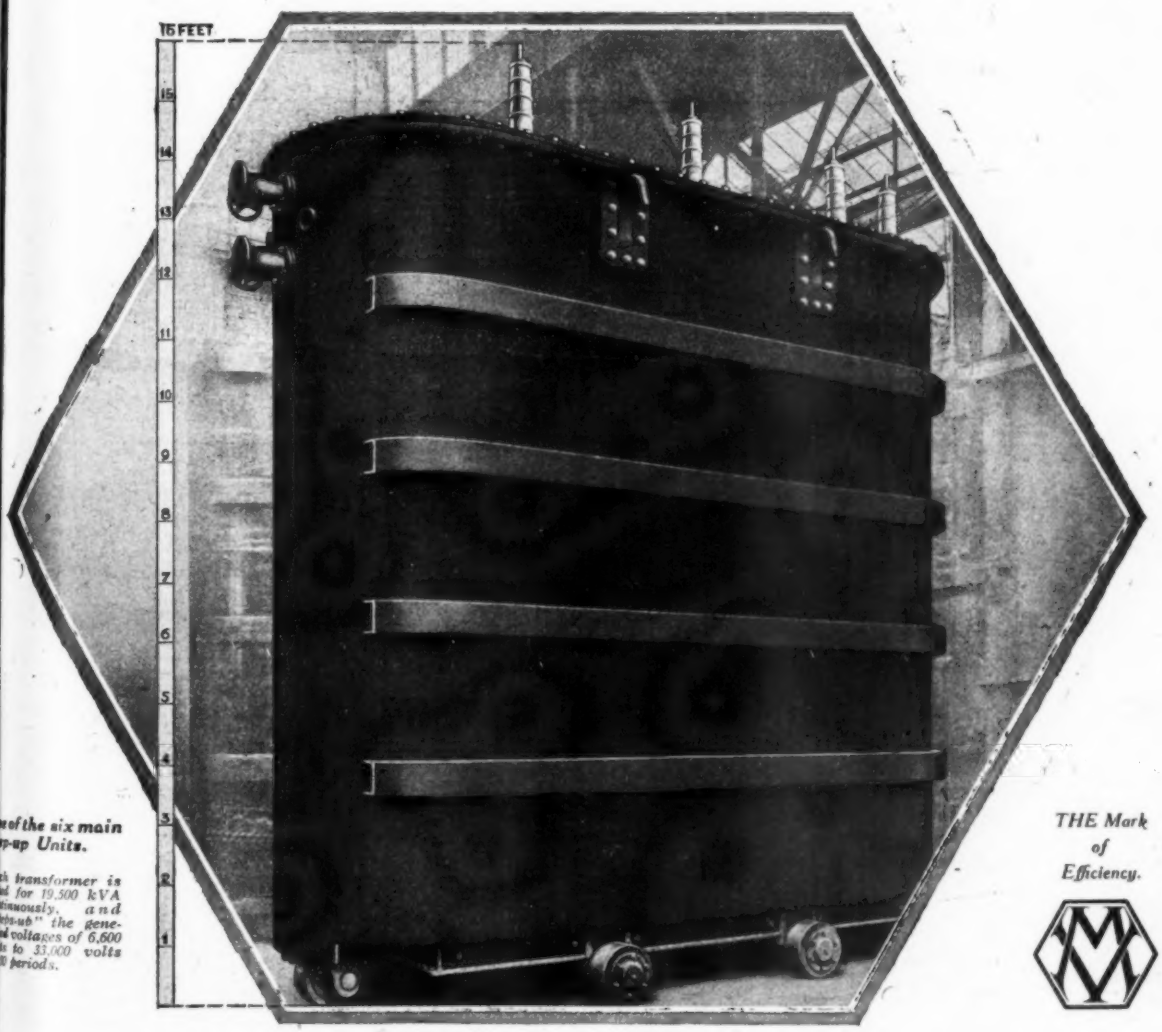
THE Mark of Efficiency

METROPOLITAN Vickers ELECTRICAL CO., LTD.
TRAFFORD PARK MANCHESTER.

ALL-"Metrovick"

All power transformers in the Barton Super-Station are "Metrovick" Transformers. They comprise:—

6—19,500 kVA MAIN STEP-UP UNITS.
3—1,250 kVA HOUSE SERVICE TRANSFORMERS.
1—2,500 kVA 50,000 volt TESTING TRANSFORMER
and in the HIGH ST. and STUART ST. Sub-stations are:—
5—8,500 kVA 3-phase banks of "Metrovick" TRANSFORMERS.



...of the six main ...p-up Units.

...h transformer is ...d for 19,500 kVA ...inuously, and ...ep-up" the gene... voltages of 6,500 ... to 33,000 volts ...0 periods.

THE Mark of Efficiency.

Send for copy of Special Publication V7370/3 on "Power Transformers."

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METROPOLITAN Vickers ELECTRICAL CO., LTD

Head Office and Works: - Trafford Park, MANCHESTER.

LEEDS
LONDON
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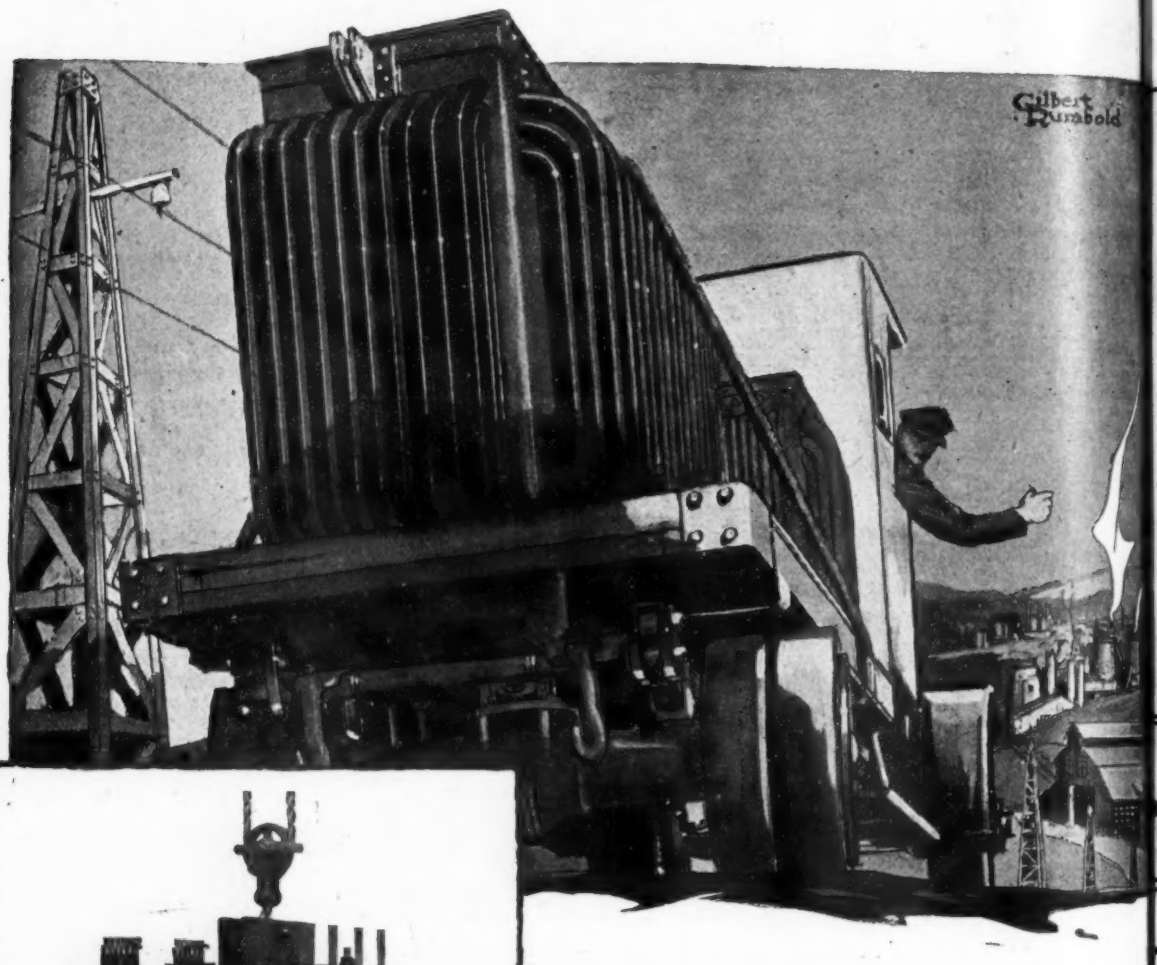
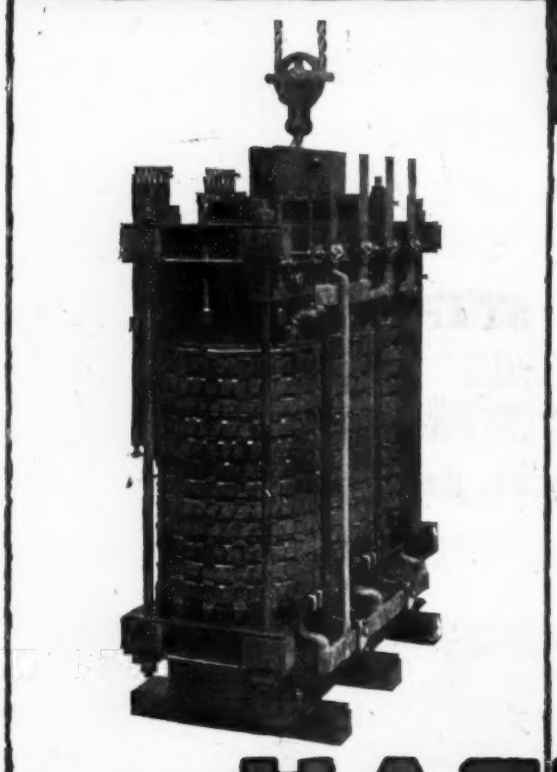
SOUTHAMPTON
SWANSEA

E 708





THE HACKBRIDGE ELECTRI
CONSTRUCTION COMPAN
manufacture Static Transforme
single and polyphase for all voltages a
frequencies and of all types and size

Many hundreds of thousands of K.V.A
already installed and working on th
mains of the largest Electric Pow
Supplies throughout The British Empir

HACKBRIDGE TRANSFORMERS

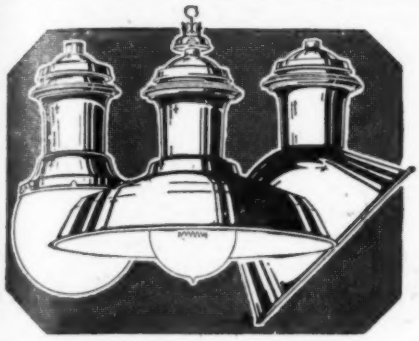
HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD
HACKBRIDGE, SURREY.

'PHONE—3UTTON 881.

"MAXLUME" REGD.

REFLECTORS AND LANTERNS

"ensure efficiency in the distribution of light."



SAVING HANDLING EXPENSES.

We deliver the bulk of our orders FROM STOCK. We do not ask you to buy quantities you do not want and carry large stocks with the consequent lock up of capital, but to use our stores as your stores, for we deliver free to you or your client under plain or your own label if you wish us to. We simplify the reflector business by cutting out all irritating extras. It is this service and the quality of our products that has enabled the "Maxlume" series to attain a world-wide sale. Catalogue E.R.945, covering the whole industrial lighting field gladly sent upon request. Your Wholesaler can supply you too.

"MAXLUME Service eliminates your carriage account."

VERITYS LTD.,

1, KING STREET, COVENT GARDEN, LONDON, W.C. 2.

BIRMINGHAM, MANCHESTER, BRISTOL, GLASGOW.

Works and Central Distributing Stores: ASTON, BIRMINGHAM.

DO NOT LET AN X-RAY OR ELECTRO-MEDICAL ORDER PASS YOU.

We can always supply.

THE

"RADIOLUX"

VIOLET RAY, HIGH FREQUENCY APPARATUS.

Complete with 4 applicators, cord, plug, &c., in carrying case, ready for immediate use,

£6 10 0

Delivery from Stock for all voltages, D.C. or A.C.

We are ACTUAL MANUFACTURERS of all kinds of

X-RAY AND ELECTRO-MEDICAL APPARATUS.

WHOLESALE
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Catalogues, showing complete range of apparatus, sent on request.

THE MEDICAL SUPPLY ASSOCIATION LTD.,

167-185, Gray's Inn Road, London, W.C.1.

The Largest X-Ray and Electro-Medical Showrooms in the British Empire.

"OZON"

(Regd. Trade Mark)

ANTI-VIBRATION ELECTRIC LAMPS.

THE LAMP THAT DEFIES VIBRATION.

GUARANTEE.—All Electric Lamps bought from us are guaranteed not to infringe any existing Patents, and if they are proved to be an infringement, we will indemnify you against any damages and costs to which you may be put, providing that our Lamps are sold under the correct titles specified by us.

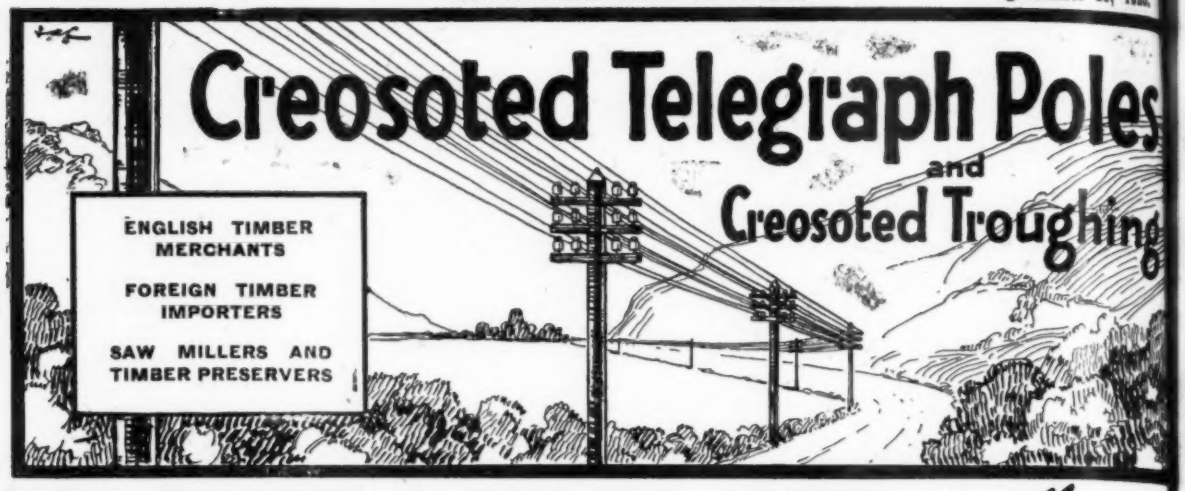
Apply to us for the name of the Distributor of "Ozon" Lamps in your District.

ANTI-VIBRATION ELECTRIC LAMP CO., LTD.,

3, LOVE LANE, EASTCHEAP, LONDON, E.C. 3.

Telephone: Mincries 1253. Telegrams: "Ruetama, Bilgate, London."

Creosoted Telegraph Poles and Creosoted Troughing



ENGLISH TIMBER MERCHANTS

FOREIGN TIMBER IMPORTERS

SAW MILLERS AND TIMBER PRESERVERS

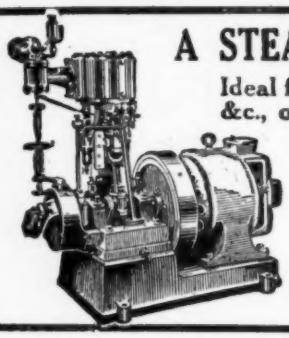
BURT, BOULTON & HAYWOOD, LIMITED,

SALISBURY HOUSE, LONDON WALL, E.C. 2.

Telephones: London Wall 7569, 7570, 7571, 7572.

POLE YARDS AT:—SOUTHAMPTON (Totton), NEWPORT (Mon.), LONDON (Silvertown).

For all Timber Requirements



A STEAM DRIVEN ELECTRIC LIGHTING SET for only £40

Ideal for Breweries, Laundries, Small Factories, Steam Tugs, Trawlers, Ferry Boats, &c., or anywhere where a supply of steam at over 50 lbs. pressure is available

CAPACITY.—Each of these Sets will light brilliantly one hundred 16 candle-power gas-filled electric lamps [illegible] total candle-power of 1600).
ENGINE.—"Robey" vertical type 5½ in. × 8 in.—steam pressure, 50 lb. or over, condensing or non-condensing
DYNAMO.—"Electromotors" compound wound, open protected type, 100 volts, 10 amperes, 700 r.p.m.
The high quality of "Robey's" Engines and "Electromotors" Generators is well known everywhere. Each of these sets originally cost over £100, so it will be appreciated that they are exceptional value as their condition is equal to new in every way. If you know anyone who has a supply of steam and would like electric light, you would be doing him a service by telling him of these sets. Write for our illustrated stock list No. 60 containing full particulars of these and many other electrical bargains.

E. W. FARROW & SONS,

— ENGINEERS, — SPALDING, LINCS. Telephone: SPALDING [illegible]

LONDON OFFICES: Premier House, 150, Southampton Row, W.C.1.

We recently tested the time taken in Scaling various Boiler Tubes with the

'SKATOSKALO' Electric Scaling Apparatus

Babcock Tubes 1" scale...	6½ mins.
Stirling Tubes 1" scale	7½ mins.
Green's Economiser Tube 1" scale	9½ mins.

Note this:—The Scale was hard as flint.
One Operator only was required.
Tubes left clean as new.
The cost of current for cleaning each tube was a few pence only.

Here's a money-saving proposition for the New Year. Write for Illustrated Literature.

F. Gilman (B.S.T.), Ltd., Grange Works, Grange Road, Smethwick, Birmingham.

Telephone: Smethwick 190.
'Grams: "Skatoskalo," B'ham.

THE WHOLESALE FITTINGS CO.,

23/27, Commercial Street,

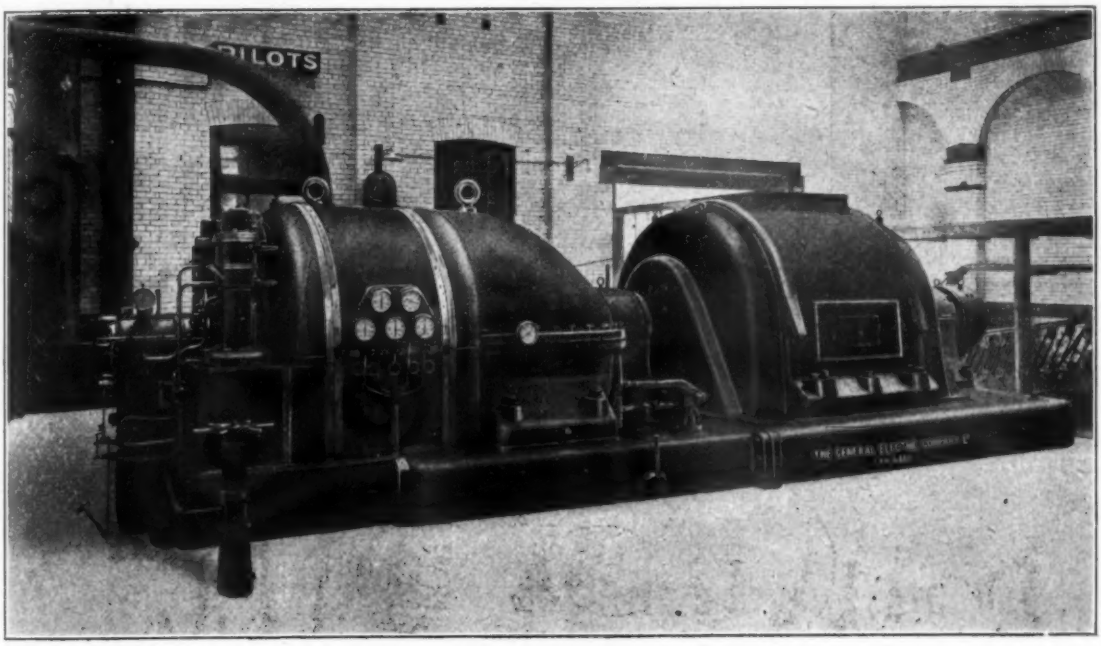
LONDON, E

Also at—

BRISTOL and MANCHESTER

GEC
FRASER & CHALMERS

TURBO – PLANT



6000 K.V.A. G.E.C.-Fraser & Chalmers Turbo-Alternator Set in a large Lancashire Municipal Power Station.
6600/7200 volts, 50 cycles, 3000 r.p.m.

The association of Fraser and Chalmers Engineering Works with the G.E.C. places this Company in the position of manufacturing complete Turbo-Power Plant Units within its own organisation.

TURBO-ALTERNATORS,
ranging from the largest to the smallest units.

TURBO-GEARED D.C. GENERATORS and TURBINE or ELECTRIC DRIVE for Mills in every industry.

High, Low, Mixed-Pressure and Pass-out Types STEAM TURBINES.

The products of the G.E.C. and its associated factories embrace the entire mechanical and electrical equipment of power plant in practically every sphere, including:

POWDERED FUEL FIRED BOILERS.
COAL and ASH HANDLING PLANT.
A.C. and D.C. GENERATORS.
ROTARY CONVERTERS.
MOTOR GENERATORS.
SWITCHBOARDS and SWITCHGEAR.
STEAM and ELECTRIC WINDING ENGINES.
ELECTRIC HAULAGE GEAR.

THE GENERAL ELECTRIC CO., LTD.

Head Office: Magnet House, Kingsway, London, W.C.2

Engineering Works: WITTON WORKS, BIRMINGHAM.
Fraser & Chalmers Engineering Works, ERITH, KENT

One Resolution you can keep for 1924

STOCK AND SELL

Osram G.E.C

GASFILLED LAMPS.

Demand is ever increasing ; your own selling efforts, backed up by powerful Osram national advertising, will combine to make 1924 a record Osram year.

Forceful selling literature, showcards and signs will be despatched to you on request.

Advt. of The General Electric Co., Ltd., Magnet House, W.C. 2.

DISPLAYED ADVERTISEMENTS

ADVERTISERS will please note that **NEW COPY and ALTERATIONS** to Existing Advertisements (with Blocks) should reach here not later than

THURSDAY MORNING.

OFFICIAL NOTICES, PATENT NOTICES, SITUATIONS VACANT, SITUATIONS WANTED, PARTNERSHIPS, AGENCIES, ARTICLES FOR SALE, ARTICLES WANTED, ETC.

Latest Time 5 p.m. TUESDAY.

The ELECTRICAL REVIEW is the recognised Medium of the Electrical Trades, and has BY FAR THE LARGEST CIRCULATION of any Electrical Industrial Paper in Great Britain.

ELECTRICAL

PARTNERS and PARTNERSHIPS

can be obtained through

WHEATLEY KIRK, PRICE & CO.

(Established 1850).

46, Watling Street, London, E.C. 4.

16, Albert Square, Manchester. 26, Collingwood Street, Newcastle-on-Tyne.

AUCTION.

G. R.

By Order of the
GEORGE COHEN & ARMSTRONG DISPOSAL CORPORATION.

GEO. N. DIXON & CO., F.A.I.,
have been instructed to Sell by Auction
at the C.S. Depot 1208.

QUEEN'S DRIVE, WALTON, near LIVERPOOL,
On THURSDAY, JANUARY 3rd, 1924,
and at the C.S. Depot 428,
AINTREE, near LIVERPOOL,
On FRIDAY, JANUARY 4th, 1924, at 11 o'clock prompt each day,

THE PLANT, MACHINERY,
AND
MISCELLANEOUS STORES,

INCLUDING: 3-ton, 2-ton and 15-cwt. Steam Loco. Cranes, with steel lattice and wood jibs, 22 ft. to 35 ft.; 20 Royce hammer-head Walking Cranes, with 12 ft. 6 in. jib; 18 a.c. and d.c. Electric Motors and Dynamos, 25 to 4 h.p.; 60-h.p. Generating Set, 500/200 volts; 400-kVA Transformer, 3,000/525 volts; 4 S.S. and S.C. Lathes, 8½-in. to 5-in. centres; 4 single-pillar Stemming Machines; Electric Tyre-bending Machine; 2 plain Grinding Machines; 29 Potato Drying Machines, by Bentley and Jackson; Corona Sensitive Drilling Machine; 3 Churchill bench ditto; 4 Portable Electric Drills. The wood-working machinery includes: 4-cutter Planer; General Joiner, to take 18-in. saw; 2 30-in. Band Saws; Morticing Machine; Circular Saw Bench.

The Miscellaneous Material includes: About 1,000 gross various Nettlefold Screws; 7 Platform Weighing Machines, from 5 cwt. to 1 ton; 1 20-cwt. Beam Scale; 100 lengths Gravity Conveyor, Wheel Barrows and Trucks; G.M., Brass, and C.I. Valves and Cocks; about 21,000 Pick Helves. Telephone Material: 50,000 wood Brackets, Ear Pieces, &c.; 223 Motor Tyres; about 3,800 Dandy Harness and Horse Brushes; Ambulance Stretchers; 2 Water Clarifiers; 450 Hydrogen Cylinders; Railway Chairs, Points and Crossings and Fish-plates; Fire Extinguishers and Brackets; Spirit Levels; 1924 G.I. Shovels; 200,000 Paper Maché Tubes; 1,400 Latrine and Fire Buckets; and a large quantity of sundry other material.

The Office and Household Furniture includes: 12 Typewriters, 27 Duplicators, Wood and Steel Filing Cabinets, Safe, 5 Gledhill Brook Time Recording Clocks, Billiard Table and Accessories, Desks, Chairs and Tables, Piano, Bedsteads, Chesterfield Suite, Oak Bedroom Furniture, and various Canteen Equipment, &c.

On view three days prior to sale.

For further particulars and catalogues (price 1s. each), apply to the Auctioneers, 41, Castle Street, Liverpool. Telephone: 3853 Bank; Telegrams: "Tenacity"; or 153/155, Abbey House, Victoria Street, London, S.W.1. 1632

SITUATIONS VACANT.

Latest time for receiving, 5 p.m. Tuesday.

Where Advertisements are to be answered to a given number at the ELECTRICAL REVIEW Office, applications for names and addresses of the Advertisers will be entirely disregarded.

METROPOLITAN BOROUGH OF STOKE NEWINGTON.

Electricity Department.

TEMPORARY Plumber-Jointer required; must have had experience on paper, lead-covered and armoured cables. Wages in accordance with No. 10 Area District Rate, at present £3 18s. 4d. per week.

Apply with copies of references to the
BOROUGH ELECTRICAL ENGINEER,
Electricity Station,
Edwards Lane, Stoke Newington, N.16. 1707

DISTRIBUTING ENGINEER.

APPLICATIONS are invited from qualified engineers for the position of Distributing Engineer to control the mains and test departments; experience with e.h.t. three-phase and d.c. supplies. Must be good organiser. Only applicants with extended experience in large undertakings will be considered.

Salary N.J.B. Schedule (London rate), Grade 3, Class F. Applications, with full particulars, to Manager, Electricity Works, Factory Lane, Croydon. 1720

THE ELECTRICAL POWER ENGINEERS' ASSOCIATION.

Halifax Corporation Electricity Department.

NOTICE is hereby given that a Dispute is in operation between the above Corporation and the E.P.E.A. Before applying for any vacancies advertised by the Corporation, all engineers are requested to communicate with the undersigned.

W. ARTHUR JONES,
General Secretary.
102, St. George's Square, London, S.W.1. 15

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

APPLICATIONS are invited for the position of 3rd Assistant Mains Engineer to a large Municipal Electricity Supply Undertaking in the North of England; only men with full technical qualifications, and experience of A.C. and D.C. Mains work need apply. Salary, Grade 9, Class F, under N.J.B. scale, amounting at present to £272 11s. per annum.—Reply to 1703, Electrical Review, 4, Ludgate Hill, London.

CANVASSER for electrical installations required by old-established firm in the Manchester area. State qualification, age and salary, or salary and commission.—1332, Electrical Review, 4, Ludgate Hill, London.

CHARGE Hand required for resistance department electrical manufacturers, South-west district; must be strict disciplinarian and used to having charge of female labour.—Reply, with full particulars of experience, age, and wage required, 6840, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

CHIEF Colliery Electrician required; must be thoroughly capable and energetic; six o'clock man, and able to take charge of a large three-phase electrical installation.—Apply, stating age, wages required, and giving references, to 1700, Electrical Review, 4, Ludgate Hill, London.

ELECTRIC Supply Company, 15 miles west of London, requires General Clerk, with knowledge of the business Commencing salary £156 per annum.—Apply, 1698, Electrical Review, 4, Ludgate Hill, London.

ESTIMATING Engineer required, experienced in the preparation of tenders for high and low-tension switchboards and starting gear. Manchester district.—State age, experience, and salary required, to 6846, Electrical Review, 4, Ludgate Hill, London.

FULLY Experienced Estimator wanted urgently, with good drawing knowledge, for small switchboards, ironclad gear, &c.; none but thoroughly capable men need apply; Manchester district; state experience and salary required; disabled ex-Service man preferred.—1704, Electrical Review, 4, Ludgate Hill, London.

LEADING Stoker required, to take charge of boiler-house, 20 miles from London; experience with large water tube boilers and chain grate stokers essential.—Reply, with full particulars as to experience and last situations, stating wages required, to 1701, Electrical Review, 4, Ludgate Hill, London.

REQUIRED, for a period of six months, Canvasser and Attendant for Electrical Showroom. Preference will be given to a candidate having had similar experience. Salary at the rate of £175 per annum, plus commission.—Apply by letter only, endorsed "Canvasser," stating age, particulars of previous experience, and enclosing copies of not more than two testimonials, to Mr. G. R. Spurr, Electrical and Tramways Engineer, Exeter Road, Walthamstow, E.17. 1723

TEMPORARY Assistant Electrical and Mechanical Draughtsman wanted, with experience in layout of power stations. Salary £5 per week.—Apply by letter, with copies of testimonials, to Norman Staniland, Electricity Works, Tottenham Lane, Hornsey, N.8. 6843

THE Lancashire Dynamo & Motor Co., Ltd., would be pleased to hear from *all* ex-members of their staff in order to commence a register of former employees for reference when customers appeal to them for technical engineers.—Write, A. P. Wood, c/o Lancashire Dynamo & Motor Co., Trafford Park, Manchester. 1697

TRAVELLER required by Manchester Elec. Wholesale House; good prospects, but must be able to introduce regular sound business. State terms and previous experiences. Applications treated in strict confidence.—"F 18," c/o W. H. Smith & Son, Advertising Agents, Blackfriars, Manchester. 6845

WANTED, qualified Electrical Engineer, good social standing, for Indian branch of a manufacturing company; previous experience of selling and erecting a.c. and d.c. plant and switchgear essential; salary £1,000 a year.—Apply, stating qualifications, to 1721, Electrical Review, 4, Ludgate Hill, London.

WANTED, young Wireman, for small central station in the Midlands. Smart man required, who is used to all systems of wiring. Chance of promotion to suitable man.—1718, Electrical Review, 4, Ludgate Hill, London.

YOUNG Man wanted, used to electrical and gas-fitting trade, as storekeeper, packer, and to assist at trade counter. Give full particulars of qualifications and salary required.—Apply by letter only, "C. A. B.," Young and Marten, Ltd., Stratford, E.15. 6838

APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

SUNDERLAND Forge & Engineering Co., Ltd. (Electrical Designer); Shropshire, Worcestershire and Staffordshire Electric Power Co. (Meter Repairer and Tester); Box 1532 (Meter Superintendent); Box 1573 (Assistant to Sales Manager); Kilmarnock Corporation (Junior Mains Engineer).

SITUATIONS WANTED.

SALES MANAGER

WITH first-class connection amongst wholesale trade and contractors. Lamps, cables, conduits and accessories, with 30 years' London experience. Good buyer and organiser; seeks engagement with progressive firm.—6756, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion. Box Number and ELECTRICAL REVIEW address count as seven words.

A.A.A.—Electrical Engineer (22), B.Sc., Eng., London, four years' technical training, college diploma, City and Guilds Final Grade Electrical Engineering and Electro-Metallurgy, seeks progressive post; French, highest references; moderate salary; short works experience.—"H. B. R.," 108, Brondesbury Villas, N.W.6. 6836

ACCOUNTANT seeks permanent position with commercial house, moderate salary.—6801, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER seeks situation as Stoker or Driver, used to alternating turbines, mechanical or hand-fed boilers, with care and maintenance; good references.—6819, Electrical Review, 4, Ludgate Hill, London.

AMBITIOUS Assistant (21), desires change with opportunity for advancement. Experience with well-known firms in showroom, travelling, estimating, &c.; good technical knowledge; excellent reference; London or Provinces.—6817, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder seeks employment, any type.—6806, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer, 40, married, seeks responsible post, charge of plant; south country; competent, energetic; a.c., d.c., steam, gas; past 8 years charge works plant.—Bunn, 1, Windsor Gardens, Brunswick Avenue, Hull. 6766

ELECTRICIAN (24), adaptable, conscientious, seeks situation; sound practical and theoretical experience, lighting, all systems, power, printing press equipment, automatic controllers, &c.—T. B., 50, Tantallon Road, Balham, S.W.12. 6812

ELECTRICIAN, good experience, requires situation; plant maintenance, motors, screwed tubing, any system wiring.—"Electrician," 31, Mason Street, Reading. 6847

ENERGETIC young man (22), technical certificate, six years' practical experience, desires progressive position in any capacity.—6841, Electrical Review, 4, Ludgate Hill, London.

ENGINEER desires appointment; experienced in d.c. single and 3-phase a.c. generation and distribution.—6839, Electrical Review, 4, Ludgate Hill, London.

GENT, residing in North Wales, desires position as Representative to manufacturers of electrical fittings, &c. Lancashire and North Wales. Small salary and commission.—6752, Electrical Review, 4, Ludgate Hill, London.

MANAGER of a firm of electrical engineers and conduit and fittings manufacturers seeks position as representative.—6834, Electrical Review, 4, Ludgate Hill, London.

MAINS Assistant; young, energetic, 11 years' experience electricity supply; used to organising and dealing with services and mains extensions, desires change; any capacity.—6769, Electrical Review, 4, Ludgate Hill, London.

NEW Year Changes of Management, &c.—Wanted, Supervision of factory, institution or estate, maintenance or erection of engines, boilers, lighting, heating, fire appliances, gas or water works. Willing to give best abilities for any position or salary offered.—6818, Electrical Review, 4, Ludgate Hill, London.

TYPIST (lady); commercial Spanish and French.—6672, Electrical Review, 4, Ludgate Hill, London.

FOR SALE.

Advertisements are inserted under this heading at 1d. per inch.

G. R.

SALE BY TENDER.

TENDERS are invited for the following plant, situate at the R.E. Experimental Station, Porton, near Salisbury:—

50-kW Generating Set, by E. Scott & Mountain, consisting of:—

Vertical twin Steam Engine, No. 707, 75 b.h.p., direct coupled to Tyne Dynamo No. 2904, d.c. 220/250 volts, 272 amps., 500 r.p.m., shunt wound. Engine and Generator mounted on c.i. base.

Tenders should be marked "Generating Set," and sent to the

Roads and Communications Officer,
Evelyn House,
Wilton Road, Salisbury,

to arrive not later than January 1st, 1924.

Any tender not necessarily accepted. 1710

FOR SALE.—*Continued.*

FOR SALE.

Switches, 5-amp. brass, quality A, 5s. 6d. doz.
Ditto, B, 4s. 9d. doz.
S.C.C.G. Lampholders, 4s. 6d. doz.
Keyswitch Lampholders, 7s. 6d. doz.
Cut-outs, 5-amp bow, 2s. doz.
Ceiling Roses, 2-plate, quality A, 2s. 9d. doz.
Ditto, B, 2s. doz.
Ditto, C, 1s. 6d. doz.
1/18 Cable, best Eng., 600 megs., quality A, 7s. coil.
Ditto, B, 6s. 3d. coil.
14/36 best twin maroon Flex, 13s. 10d. gross yds.
3½ x 1 best English W.E. Blocks, 13s. gross.
Ditto, I.W. Blocks, 12s. gross.
G.E.C. best Aerial Wire, hard drawn, 1s. 4½d. 100 ft.
Dutch Valves, tubular and R type, amplifying and detecting, 4s. 9d. in doz. lots.
Headphones, best Continental, from 9s. 6d. pair, guaranteed.
Electric Irons, 4, 5, 6 lb., heavy nickel finish; limited supply; complete flex and adapter, 6s. 6d.
Electric Lamps:—
Metal filaments, every size and voltage, 8s. 9d. doz.
60, half-watt type, 13s. 6d. doz.
100, half-watt type, 19s. doz.
All lamps guaranteed. 2½ per cent. cash with order. Carriage paid on orders over £3.

S. DAVIS & CO.,
Artillery House, 226, Bishopsgate, E.C. 6848

ELECTRIC PLANT FOR SALE.

NAVAN Urban Council invite offers for following plant:—
One Wilson Hartnell comp. Generator, 220 V, 125 amps., 825 r.p.m.
One Shunt Newton comp. Generator, 220/300 V, 70 amps., 720 r.p.m., with S.C. switch. Overhead mains, wood poles, insulators, brackets, &c. (standing).
60 Reason Meters, 5 and 10 amp., 220 V.
All in good condition, and only recently taken over from Messrs. J. Spicer & Co., Ltd. Offers will be considered for the whole or part of the plant.

L. O'CLEIRIGH,
Acting Clerk.
U.D.C., Navan, Co. Meath. 1706

FOR SALE.

Motor Generator, for accumulator charging, direct coupled, on cast-iron bedplate. Motor, 230 volts; generator, 24 volts, 18 amps., £20.

Two 1/6th-h.p., 2-phase, 220-volt, 50-cycle, a.c. Motors, 1,425 r.p.m., £4 each.

One 2-h.p., 2-phase, 220-volt, 50-cycle, a.c. Motor, 1,450 r.p.m., £7 10s.

PRATT BROS. (EDINR.), LTD., 98, Dalry Road, Edinburgh. 1705

MOTORS AND FANS.

200/250 volts, d.c.: 3, 5, 7, 8, 10, 15, 18, 20, 25, 50, 65, 150.
400/500 volts, d.c.: 5, 10 (tot. encl.), 15, 20, 25, 30, 40, 65, 75, 80, 110 h.p.
400/500 volts, 3-phase, 50 periods: 1, 2, 4, 6, 10, 12, 18, 20, 40 h.p.
200/220 volts, 3-phase, 50 periods: 10 h.p.
200 volts, 1-phase, 50 periods: 18 h.p., slip-ring.
Ventilating Fan, 30 in., 230 volts, d.c., box blades.

GREENHALGH BROS., Atherton, Manchester.
'Phone: 117. Telegrams: Greenhalgh Bros., Atherton. 17

GENERATING SETS.

TWO 500-kW Generating Sets, 500/550 volts, three-crank, enclosed Engines; Dick, Kerr compound Dynamos, Allen Surface Condensing Plant, complete, Baker's Oil Separator. Very low price. Also Diesel Engines, 800 to 1,200 h.p.

JENNINGS, West Walls, Newcastle-on-Tyne. 6

SHEFFIELD CORPORATION TRAMWAYS AND MOTORS.

THE Tramways and Motors Committee have for disposal:—
Nine B.T.H.-type, G.E.52, Tramway Traction Motors.
Six B.T.H.-type, B6, Tramway Controllers.
Six B.T.H.-type, B13, Tramway Controllers.
All in good condition and working order.

Fullest inspection, and expert examination invited.
Further information may be obtained from the undersigned.

A. R. FEARNLEY,
Division Street, Sheffield, *General Manager.*
December 29th, 1923. 1669

FOR SALE.—*Continued.*

OLDFIELD ENGINEERING CO., LTD.,
Hampson Street, Salford.

Telegrams: "Stalwart, Manchester."
Telephone: City 8620, Manchester.

D.C. MOTORS IN STOCK.

Volts.	B.H.P.	Speed.	Make.
440	200	485	Vickers.
440	40	600	Vickers.
440	30	400	Mather.
440	25	445	Mather.
440	25	1300	Electromotors.
440	17	580	Woolnough.
440	10	600	Vickers.
480	10	1000	Verity.
440	10	600	Vickers.
440	5	1200	Wright.
440	3	1250	Westinghouse.
440	3	700	Standard.
440	3	1100	Rochdale Electric.
440	2	1200	B.T.H.
500	1	1360	Holmes.
230	55	830	Crompton.
230	45	680	Crompton.
220	20	1100	G.E.C.
230	20	730	Royce.
200	20	600	Peebles.
220	16	960	English Electric.
220	10	1200	English Electric.
220	7½	1150	Westinghouse.
220	5	1150	Crompton.
220	3	1200/1800	Siemens.
220	2	1350	A.E.G.
110	30	850	Westinghouse.
110	15	940	Westinghouse.
100	12	450/1050	Harland.

SERIES WOUND, D.C. MOTORS IN STOCK.

440	2	680	L.D.M.
220	5	1000	Electromotors.

D.C. DYNAMOS IN STOCK.

550	52-kW	850	Brush.
230	35-kW	885	G.E.C.
110	30-kW	350	Westinghouse.

3-PHASE, 50 CYCLE, A.C. MOTORS IN STOCK.

440	250	292	Peebles.
420	60	730	E.C.C.
500	60	730	B.T.H.
400	15	950	B.T.H.
440	7½	1440	E.C.C.
220	12	480	Sandycroft.

Petrol-Electric Generating Set, 11-kW, 225-volt, 1,000-r.p.m. Mawdsley Dynamo, coupled to D.B. & H. three-cyl. water-cooled Engine; £60 or near offer.
All tested and despatched in guaranteed first-class working order.
Enquiries and inspection invited. 1719

FOR SALE AT KNOCK-OUT PRICES TO AVOID BRINGING INTO STOCK.

Willans Steam Generating Set, coupled to pair of Westinghouse 32½-kW, 6-pole Generators, each 320 volts, 102 amps.
Two Willans ditto, each coupled to one 97½-kW, 6-pole Generator, 460/550 volts.
Two Willans ditto, each coupled to 500-kW Alternator, 6,600 volts, 44 amps., 50 cycles, 3-phase.
Two Willans ditto, each coupled to 195-kW Generator, 420 amps., 350 revs.
Three sets of Surface Condensing Plant, each complete with Air Pump, Valves, and all accessories, each capable of dealing with exhaust steam from a 200-kW Generating Set.
Two sets of ditto by Storey & Sons, capable of dealing with steam from a 500-kW alternator set.
Three Babcock & Wilcox Water-tube Boilers, each containing 81 4-in. tubes, Steam Drum 24 ft. 3 in. x 4 ft., capable of evaporating 6,000 lb. each, working at 200 lb. pressure, fitted with Superheater, 276 sq. ft. heating surface, complete with Hopkinson mountings.
One Green's Economiser, 192 tubes, Patent Scraper Gear, driven by 4-pole, d.c. Motor, 460 volts, 4 b.h.p.
Small Babcock & Wilcox cross-type Boiler, 889 sq. ft. heating surface, 200 lb. pressure.

GEO. COHEN, SONS & CO.,
600, Commercial Road, E.14. 6813

ON SALE CHEAP FOR CASH.

200-VOLT, 83-CYCLE, SINGLE-PHASE MOTORS, IN NEW CONDITION.
One 25 h.p., slip-ring. One 9 h.p., slip-ring. One 15 h.p., slip-ring. All complete with Starters.
Several small h.p. induction-type Motors and Starters.
GEO. MORRISON, Electrical Engineer, 24, Birley Street, Blackpool. 1520

FOR SALE.—*Continued.*

MYLAN & SMITH (ENGINEERS), LTD.,

KELVIN HOUSE,

St. James' Street, Sheffield.

'Phone: 4976, 4977, Central, Sheffield.
'Grams: "Topical," Sheffield.
Works: Bamford, Derbyshire, Midland Railway.

Every Machine in our Own Stock.

TWO-PHASE, 50 PERIODS, 200 VOLTS.

One 5 h.p., 1,440 revs., squirrel cage, Elec. Co.
One 5 h.p., 950 revs., squirrel cage, G.E.C.
One 5 h.p., 570 revs., squirrel cage, Fuller.
One 25 h.p., 940 revs., slip-ring, Westinghouse.

THREE-PHASE, 40 PERIODS, 400/440 VOLTS.

One 2 h.p., 565 revs., squirrel cage, Westinghouse.
Three 3 h.p., 1,120 revs., squirrel cage, Phœnix.
Three 7½ h.p., 760 revs., squirrel cage, Westinghouse.
One 12 h.p., 760 revs., slip-ring, Phœnix.
One 12 h.p., 475 revs., slip-ring, Phœnix.
One 16 h.p., 575 revs., squirrel cage, B.T.H.
Two 25 h.p. 1,150 revs., slip-ring, Sandycroft.
One 25 h.p., 575 revs., squirrel cage, L.D. & M.
One 25 h.p. 385 revs., squirrel cage, L.D. & M.
One 40 h.p., 760 revs., slip-ring, Sandycroft.
One 40 h.p., 390 revs., slip-ring, Siemens.
One 48 h.p., 580 revs., slip-ring, Siemens.
One 55 h.p., 580 revs., slip-ring, Siemens.

THREE-PHASE, 40 PERIODS, 2,750 VOLTS.

One 80 h.p., 575 revs., slip-ring, Westinghouse.
One 280 h.p., 292 revs., slip-ring, Westinghouse.

THREE-PHASE, 50 PERIODS, 400/440 VOLTS.

One 2½ h.p., 705 revs., squirrel cage, Westinghouse.
One 3 h.p., 1,430 revs., squirrel cage, Phœnix.
Sixteen 4 h.p., 1,420 revs., squirrel cage, L.D. & M.
One 4½ h.p., 1,430 revs., squirrel cage, Phœnix.
Seven 5½ h.p., 1,420 revs., squirrel cage, L.D. & M.
Six 5½ h.p., 1,420 revs., squirrel cage, L.D. & M.
One 6 h.p., 2,850 revs., squirrel cage, Fuller.
Three 6 h.p., 1,460 revs., squirrel cage, G.E.C.
Nine 7½ h.p., 1,440 revs., slip-ring, E.C.C.
Three 7½ h.p., 950 revs., squirrel cage, Westinghouse.
Seven 8 h.p., 1,420 revs., slip-ring, L.D. & M.
One 9 h.p., 1,450 revs., squirrel cage, E.C.C.
Three 9 h.p., 1,460 revs., squirrel cage, G.E.C.
Seven 10 h.p., 960 revs., slip-ring, Macfarlane.
Three 10 h.p., 950 revs., squirrel cage, Westinghouse.
One 15 h.p., 950 revs., slip-ring, Phœnix.
One 15 h.p. 580 revs., slip-ring, Phœnix.
Three 20 h.p., 960 revs., slip-ring, Macfarlane.
One 20 h.p., 715 revs., squirrel cage, B.T.H.
Three 25 h.p., 960 revs., slip-ring, Macfarlane.
One 25 h.p., 480 revs., squirrel cage, L.D. & M.
Two 30 h.p., 1,440 revs., slip-ring, Sandycroft.
Four 30 h.p., 720 revs., squirrel cage, E.C.C.
One 30 h.p., 720 revs., squirrel cage, L.D. & M.
Two 50 h.p., 970 revs., slip-ring, Sandycroft.
One 50 h.p., 750/725 revs., slip-ring, Siemens.
One 50 h.p., 488 revs., slip-ring, Siemens.
One 60 h.p., 720 revs., squirrel cage, Siemens.
Three 60 h.p., 575 revs., squirrel cage, E.C.C.

THREE-PHASE, 50 PERIODS, 500/550 VOLTS.

One 3 h.p., 1,420 revs., squirrel cage, Westinghouse.
One 3 h.p., 705 revs., squirrel cage, Westinghouse.
Two 4 h.p., 1,430 revs., squirrel cage, Phœnix.
Ten 5 h.p., 1,420 revs., squirrel cage, L.D. & M.
Six 6½ h.p., 1,420 revs., squirrel cage, L.D. & M.
Two 10 h.p., 1,460 revs., squirrel cage, G.E.C.
Four 10 h.p., 950 revs., squirrel cage, Westinghouse.
One 15 h.p., 950 revs., slip-ring, Phœnix.
One 15 h.p., 580 revs., slip-ring, Phœnix.
One 20 h.p., 715 revs., squirrel cage, B.T.H.
One 25 h.p., 480 revs., squirrel cage, L.D. & M.
One 30 h.p., 1,440 revs., slip-ring, Sandycroft.
One 30 h.p., 720 revs., squirrel cage, L.D. & M.
One 50 h.p., 970 revs., slip-ring, Sandycroft.
One 50 h.p., 488 revs., slip-ring, Siemens.
Two 60 h.p., 725 revs., slip-ring, Siemens.
One 65 h.p., 720 revs., slip-ring, Siemens.

THREE-PHASE, 50 PERIODS, 3,000/3,300 VOLTS.

One 100 h.p., 720 revs., slip-ring, Westinghouse.
One 350 h.p., 365 revs., slip-ring, Westinghouse.

WE WILL QUOTE YOU
BY TELEGRAM, TELEPHONE,
OR RETURN OF POST.

FOR SALE.—*Continued.*

ELECTRIC MOTORS—CUT PRICES.

All Machines Guaranteed.

ONLY best makes. Nearly all new, thoroughly overhauled and tested before despatch.

DIRECT CURRENT, 110 VOLTS.

Four ¼ h.p., 1,350/1,500 revs., shunt wound, G.E.C.
One 2 h.p., 750/2,000 revs., shunt wound, Mawdsley.
One 4 h.p., 550 revs., shunt wound, Electromotors.
Two 5 h.p., 600 revs., shunt wound, E.E.C.
Eight 20½ h.p., 375/750 revs., series wound, L. Scott.
One 23 h.p., 575 revs., shunt wound, Mawdsley.
One 35 h.p., 500 revs., shunt wound, Verity.

DIRECT CURRENT, 220/230 VOLTS.

Three 3 h.p., 1,200/1,800 revs., shunt wound, Siemens.
One 5 h.p., 1,200 revs., shunt wound, B.T.H.
Three 5 h.p., 1,000 revs., shunt wound, Siemens.
One 8 h.p., 1,100 revs., shunt wound, Electromotors.
One 10 h.p., 1,400/1,700 revs., shunt wound, Mawdsley.
Seven 10 h.p., 1,200 revs., shunt wound, E.C.C.
Four 10 h.p., 800 revs., shunt wound, G.E.C.
Four 10 h.p., 800 revs., compound wound, G.E.C.
Three 10 h.p., 750 revs., compound wound, Macfarlane.
One 10 h.p., 575 revs., compound wound, Macfarlane.
One 15 h.p., 1,160 revs., shunt wound, Mawdsley.
One 15 h.p., 1,150 revs., shunt wound, Royce.
Four 15 h.p., 500 revs., shunt wound, G.E.C.
Two 20 h.p., 1,250 revs., shunt wound, G.E.C.
One 20 h.p., 725 revs., shunt wound, Royce.
Seven 20½ h.p., 750 revs., series wound, Verity.
One 26 h.p., 600 revs., shunt wound, Newtons.
Three 40 h.p., 400 revs., shunt wound, G.E.C.
One 45 h.p., 1,100 revs., shunt wound, Verity.
Three 45 h.p., 850 revs., shunt wound, Electromotors.
One 46 h.p., 1,150 revs., shunt wound, Mawdsley.
Seven 50 h.p., 660/900 revs., shunt wound, Royce.
Two 50 h.p., 400 revs., shunt wound, G.E.C.
One 60 h.p., 700 revs., compound wound, Phœnix.
Three 60 h.p., 600/900 revs., shunt wound, Royce.
One 70 h.p., 995 revs., shunt wound, Verity.
Two 75 h.p., 725 revs., shunt wound, Siemens.
Five 75 h.p., 600 revs., shunt wound, Royce.
Two 87½ kW, 850 revs., shunt wound, Electromotors.
One 1,000 h.p., 245 revs., shunt wound, Vickers.

DIRECT CURRENT, 440/500 VOLTS.

Two 4½ h.p., 900 revs., shunt wound, Siemens.
One 5 h.p., 1,000 revs., shunt wound, Verity.
One 7 h.p., 1,190 revs., shunt wound, Siemens.
Nine 7 h.p., 1,050 revs., shunt wound, Siemens.
One 7½ h.p., 1,320 revs., shunt wound, Siemens.
Fourteen 7½ h.p., 1,150 revs., shunt wound, Siemens.
One 18 h.p., 800 revs., shunt wound, Verity.
One 20 h.p., 900 revs., shunt wound, Verity.
One 32 h.p., 920 revs., compound wound, Crompton.
One 35 h.p., 1,000 revs., shunt wound, Crompton.
Eight 40 h.p., 600 revs., shunt wound, Vickers.
One 45 h.p., 880 revs., compound wound, Crompton.
One 45 h.p., 850 revs., shunt wound, Newtons.
Five 45 h.p., 680 revs., shunt wound, Vickers.
One 50 h.p., 1,000 revs., shunt wound, Crompton.
One 50 h.p., 925 revs., shunt wound, Newtons.
Two 100 kW, 325 revs., shunt wound, Crompton.
Two 115 kW, 380 revs., shunt wound, Crompton.
One 185 h.p., 478 revs., compound wound, J. P. Hall.
One 210 h.p., 540 revs., compound wound, J. P. Hall.

MYLAN & SMITH (ENGINEERS), LTD.,
Kelvin House, St. James' Street, Sheffield.

'Phone: 4976, 4977, Central, Sheffield.
'Grams: "Topical," Sheffield.
Works: Bamford, Derbyshire, Midland Railway. 3

TURBO-ALTERNATORS FOR SALE IN FRANCE.

SEVERAL new or second-hand modern Turbo-Alternator Sets. Very low price, owing to rate of exchange.

Two 6,000 kW, Brown, Boveri, 3-phase, 50 cycle.
Two 3,000 kW, Zoelly & Rateau, 3-phase, 50 cycle.
One 2,200 kW, Zoelly, 3-phase, 25 cycle.
One 2,000 kW, Zoelly, 3-phase, 50 cycle.
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Also Rotary Converters, Steam Generating Sets, Diesel Engines, Boilers, &c. Complete list on application.

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EDISON SWAN ELECTRIC COMPANY, LTD.

THE 40th ordinary general meeting of the Edison Swan Electric Co., Ltd., was held yesterday at Cannon Street Hotel, E.C., Mr. C. F. Spencer (the chairman) presiding.

The Chairman, in moving the adoption of the report and accounts, first dealt with the balance sheet. He said that the stocks (including work in progress) had been valued by the company's officials at £334,065. In this business it was necessary to carry large stocks to meet the diversified demands due to the different systems of supply of electrical energy in this country, and the wireless branch of the business, which they were conducting with success, had increased both the classes and quantity of stocks. They had endeavoured to value the stocks on a very conservative basis, having due regard to the character of the stock and the susceptibility of some part of it to change in fashion. Figures taken out showed that 35 per cent. of the total stock, &c., represented work in progress and raw materials for use in manufacture, while the balance was made up of finished units ready for sale. The item of loans, &c., £314,150, was the amount of debt due to their bankers at June 30th last, but this had since been reduced to £289,450, and would be further reduced by a repayment of £30,000 on December 31st, 1923. During the next half-year they hoped to make other substantial repayments. The directors' report set out fully the board's recommendation as to the disposal of the profit of £71,162, and it was anticipated that the balance to be carried forward to next year would, after payment of Corporation profits tax, be in excess of £11,000.

Proceeding, the chairman said the policy of the board may be summed up quite shortly as follows:—

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3. To build up an adequate reserve fund, and if you adopt our recommendations to-day, as I am sure you will, the first contribution to such a fund will have been made.

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Mr. A. F. Berry (deputy chairman) seconded the motion, which was carried unanimously, and dividends of 7½ per cent. for the past year were declared on the preference and ordinary shares.

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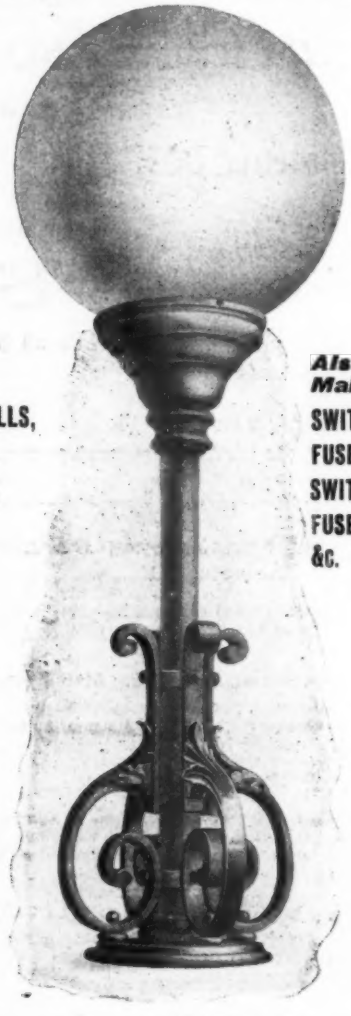

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"The primary object of this book is to provide a 'practical aid' to those who have under their care the running, maintenance and repair of three-phase induction motors, and have not either the training or experience necessary to deal with the many practical problems that arise from time to time."

"Among the ever-increasing number in this class are many to whom this work should appeal. It deals with the two classes of motors most widely used, i.e., 'squirrel cage' and 'slip ring' machines. The construction of these machines is dealt with in detail, as is their starting apparatus, faults, &c., emphasising the good points they should embody and the weak ones to be avoided."

"Whilst it is impossible to quote a remedy for every evil, because circumstances differ so widely yet the suggestions contained herein may prove helpful if only from the knowledge that such exist. It is the practice in most plants using a number of motors to carry out their own repairs, because they can be done so much cheaper and better, quality being the first essential."

"Mathematics and useless theory are excluded, for the simple reason that for the class to whom this work appeals none are necessary. So long as the practical man understands the rudiments of the principles on which motors operate, that is all he needs."

"The photos and diagrams contained herein were taken and drawn by the author expressly for this work, and taken from ordinary routine work of a large plant."

"No one manufacturer's motors or apparatus are specifically referred to."

"The contents of this book are founded on twenty years' experience in the erection, running, maintenance and repair of electrical plant and equipment ranging from a few hundred horse power to 10,000 horse-power in various parts of the world."

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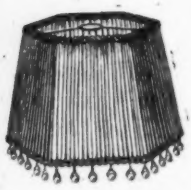

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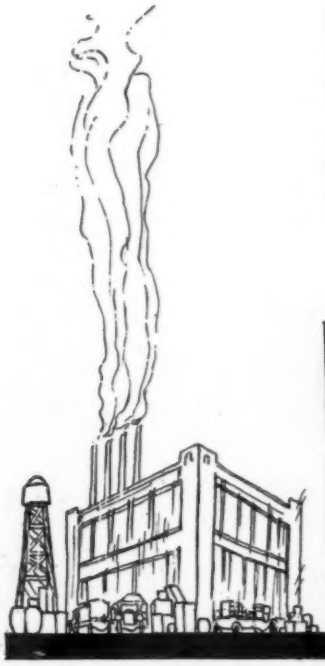

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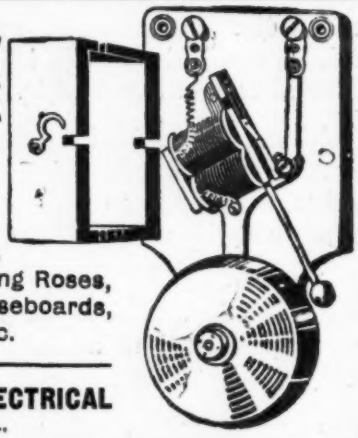

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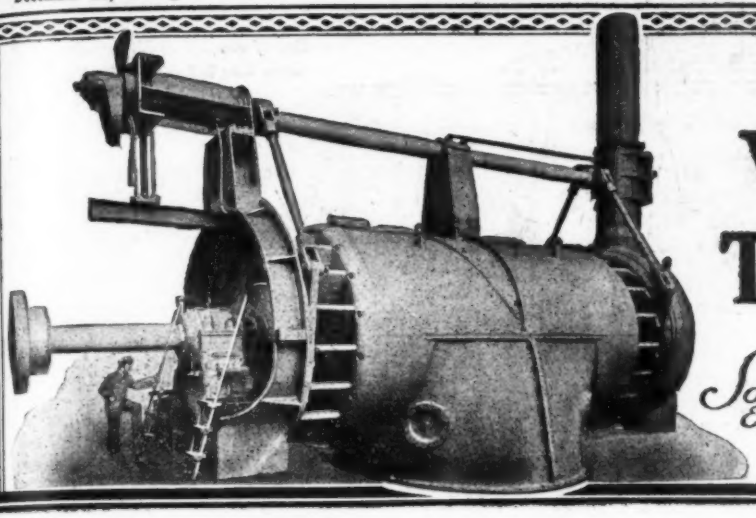

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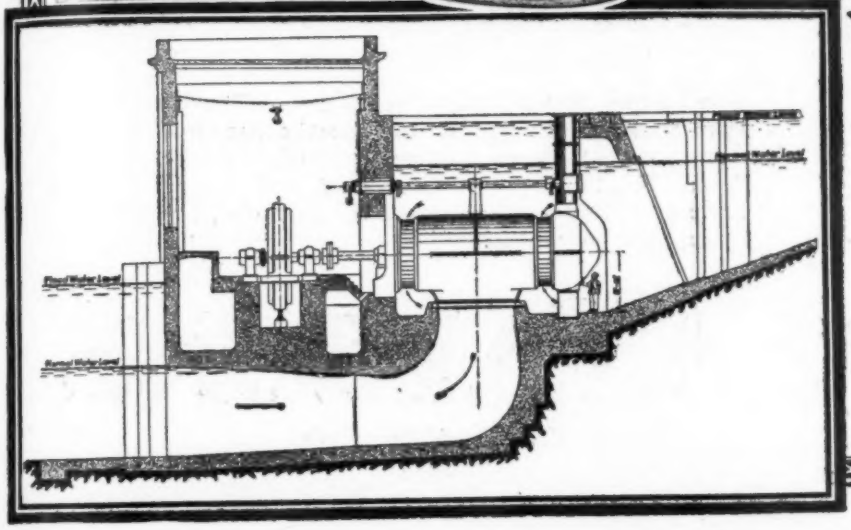

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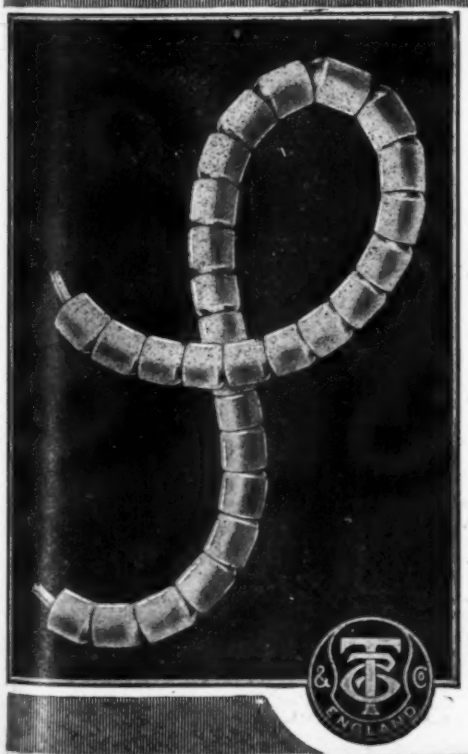

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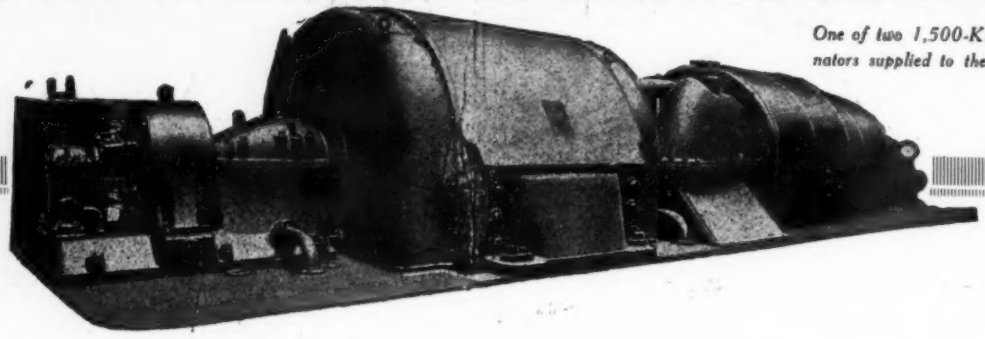

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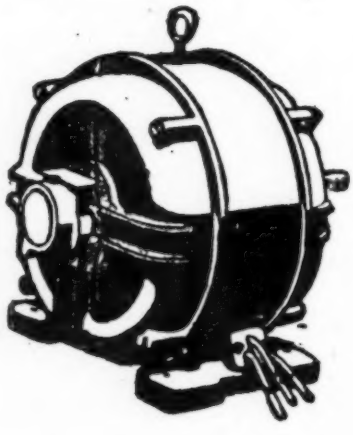

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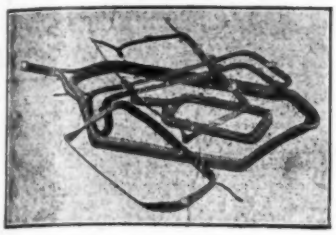

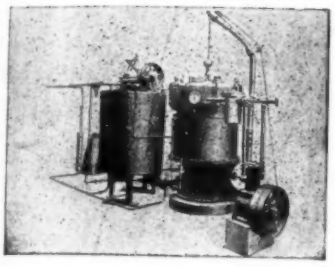

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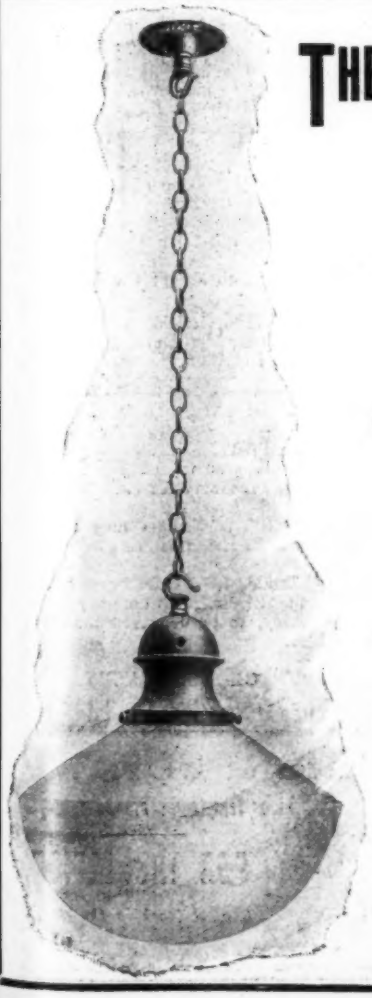

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OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Tuesday.

STATE ELECTRICITY COMMISSION OF VICTORIA, Melbourne, Victoria, Australia.

TENDERS are hereby invited for the supply, delivery, &c., of the following, for the Morwell Power Scheme.

Copies of tender form and specification will be available upon application to:—

Agent General for Victoria,
Melbourne Place, Strand,
London, W.C.2.

SPECIFICATION No. 24/4.—FOUR ONLY, 100 KVA, 25,400-6,600 V, TRANSFORMERS AND SPARES.

Charge.—10s. for the first two copies of tender form, conditions of contract, and specification complete. This charge will be returned on receipt of a *bona-fide* tender. A third copy and further copies will be supplied for the sum of 5s. each. This charge is not returnable.

Preliminary Deposit.—A preliminary deposit of £10 is to be lodged with tender.

The specification may be inspected at the above mentioned office.

The Commission does not bind itself to accept the lowest or any tender.

Tenders, on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 5 p.m., February 11th, 1924.

R. LIDDELOW,
1687 *Secretary.*

COUNTY BOROUGH OF HASTINGS.

Electrical Department.

TENDERS are invited for the supply, delivery and erection of:—

Steel Constructional Buildings.
Steel Plate Coal Bunkers and Chutes.
Reinforced Concrete Pond and Plant Foundations.

Specification and tender form will be available on application to the Borough Electrical Engineer, 20, South Terrace, Hastings.

Tenders, on prescribed forms, must be delivered to the undersigned not later than noon, January 21st, 1924.

D. W. JACKSON,
Town Hall, Hastings. *Town Clerk.*
December 21st, 1923. 1711

CITY AND COUNTY BOROUGH OF CANTERBURY.

Electricity Department.

THE Lighting Committee invite tenders for the supply and delivery of low-tension, lead-covered and armoured Feeder Cable.

Particulars may be obtained from the undersigned.

Tenders, endorsed "Tender for Cable," to be delivered to the Electricity Works, Canterbury, by January 14th, 1924.

C. A. BLASCHECK,
1716 *Engineer and Manager.*

COUNTY BOROUGH OF STOKE-ON-TRENT.

Electricity Department.

IRONCLAD LOW-TENSION SWITCHGEAR.

TENDERS are invited for the above for the Central Power House.

Specification and form of tender may be obtained from the Borough Electrical Engineer, St. Peter's Chambers, Glebe Street, Stoke-on-Trent, on the sum of £2 being deposited with him, which sum will be returnable on receipt of a *bona-fide* tender.

Tenders are to be delivered to the undersigned by noon on January 16th, 1924.

E. B. SHARPLEY,
Town Hall, *Town Clerk.*
Stoke-on-Trent.
December 28th, 1923. 1715

METROPOLITAN BOROUGH OF FULHAM.

TENDERS are invited for the following plant and accessories delivered and erected complete at the generating station, Townmead Road, Fulham, S.W.6.

(1) Two 6,000-kW, 3-phase Turbo Alternators.
(2) Three high-pressure Water-tube Boilers, with Economisers, Stokers, Soot Blowers, &c.

Specifications can be obtained (and will be supplied to makers only) on application to the Borough Electrical Engineer, Mr. Arthur J. Fuller, Electricity Works, Townmead Road, Fulham, S.W.6.

Tenders to be sent in not later than 12 noon on January 16th, 1924, endorsed "Electricity Extensions," and addressed to J. Percy Shuter, Esq., Town Clerk, Town Hall, Fulham, S.W.6. 1714

BOROUGH OF BRIDLINGTON.

Electricity Works—Boiler.

THE Council invite tenders for the supply and fixing of a 30 ft. x 7 ft. 6 in. Lancashire Boiler with the necessary brick work and settings. Further particulars and information may be obtained on application to the Borough Electrical Engineer, Electricity Works, Brett Street, Bridlington. Tender endorsed "Boiler" must be delivered to the Borough Electrical Engineer at above address not later than Monday, January 14th, 1924.

The Council do not bind themselves to accept the lowest or any tender.

GEORGE MELVIN,
Town Hall, Bridlington, *Town Clerk.*
December 20th, 1923. 1702

METROPOLITAN BOROUGH OF ISLINGTON.

Contracts for Electrical and Engineers' Stores.

THE Council invite tenders for one year commencing on April 1, 1924, for the supply of:—

(1) Cables.
(2) Electricity Supply Meters.
(3) Cable, Terminal, Service, Network and Fuse Boxes, Cast-iron Pipes, Tapes, and Iron Castings.
(4) Electrical Sundries, Wires, Lamps, &c.
(5) Transformers.
(6) Arc Lamp Carbons.
(7) Lamp Globes.
(8) Transformer Tanks.
(9) Earthenware Pipes, Troughs, Insulators, Firebrick, Fireclay and Bricks.
(10) Oils and Lubricants.
(11) Engine-room Stores.
(12) Steel, Iron, Tools, Belting, Rope, &c.

Forms of tender, specification and contract may be obtained on application to the undersigned on or after Wednesday, January 2nd, 1924. Samples of apparatus and goods tendered for should be forwarded to the Electrical Engineer, Electricity Works, 60, Eden Grove, Holloway, N.7.

Tenders, properly endorsed, must be delivered to the undersigned not later than noon on Wednesday, January 30th, 1924.

(By Order) C. G. E. FLETCHER,
Municipal Offices, *Town Clerk.*
Tyndale Place,
Upper Street, N.1.
December 20th, 1923. 1709

BOROUGH OF KEIGHLEY.

Two 30,000-lb. Water-tube Boilers, Stokers, Economisers, Bunkers and Fans.

THE Electricity Committee invite Tenders for the supply, delivery and erection of the above plant, with the necessary auxiliaries, which is to be installed at their generating station situated in Coney Lane, Keighley.

Specification and form of tender may be obtained from the undersigned upon payment of a deposit of £1 1s. in respect to each specification. Such deposits will be returned to all contractors who submit a *bona-fide* tender.

Sealed tenders, suitably endorsed, must be delivered to the Town Clerk, Town Hall, Keighley, not later than Monday, January 14th.

The Committee will not be bound to accept the lowest or any tender.

HARRY WEBBER, M.I.E.E., M.I.Mech.E., M.I.T.,
Borough Electrical Engineer & General Manager.
Electricity Offices, Coney Lane, Keighley,
December 24th, 1923. 1724

COUNTY BOROUGH OF WALLASEY.

ELECTRICITY DEPARTMENT.

THE Electricity Committee is prepared to consider Tenders for the supply and delivery of Thirty Air-cooled Transformers.

Copy of the Specification and full particulars may be obtained on application to the Borough Electrical Engineer, Sea View Road, Wallasey.

Sealed Tenders, endorsed "Tender for Transformers," addressed to the Chairman of the Electricity Committee, c/o Town Clerk, Town Hall, Wallasey, to be delivered not later than Friday, January 18th, 1924.

By order,

GEORGE LIVSEY,
Town Hall, Wallasey, *Town Clerk.*
December 22nd, 1923. 1722

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Berry's Electric, Ltd., 5, Deansgate, Manchester.
Berry's Electric, Ltd., Oozells Street, Birmingham.
Robert Bowran & Co., Ltd., 4, St. Nicholas Buildings, Newcastle-on-Tyne.
Wm. McGeoch & Co., Ltd., 28, West Campbell St., Glasgow.
Simpson, Baker & Co., 2-5, Nelson Street, Bristol.
Berry's Electric, Ltd., 16, Donegal Square South, Belfast.
Berry's Electric, Ltd., 94-96, Middle Abbey St., Dublin.
Fred. S. Lee, Ltd., 38, Market St., Sydney, N.S.W.
Balmer, Lawrie & Co., Calcutta.
Greaves, Cotton & Co., 1, Forbes Street, Bombay.
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Ernest Demoly, 43, Rue de Treviso, Paris.

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Could you do this with any other Battery?

We have often invited visitors to our works to select any Battery from a stock and throw it as far as they can on to a hard concrete floor. We have afterwards proved that the Battery was undamaged in any way.

The reason is that the larger part of

THE "NI-FE" BATTERY

is hardened steel—steel container, steel frames to hold steel strips—thus the "NI-FE" will withstand such blows, jars, vibrations and bumps as would put the ordinary battery out of service.

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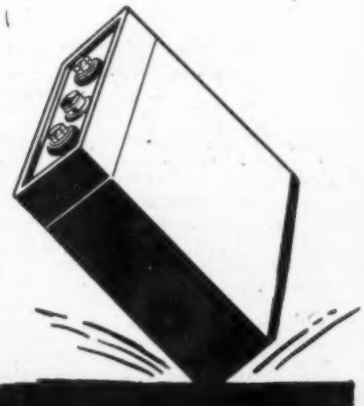

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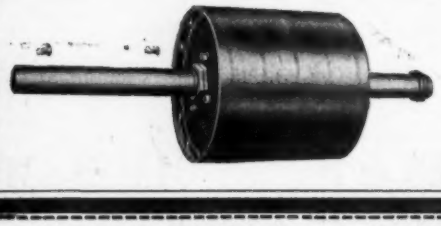

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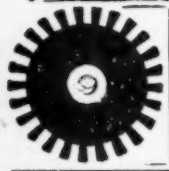
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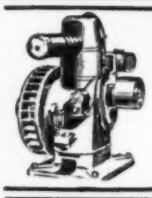
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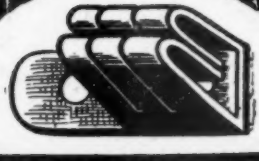
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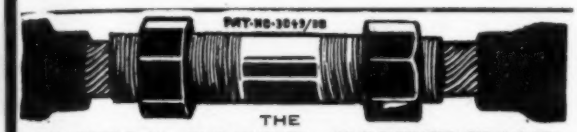

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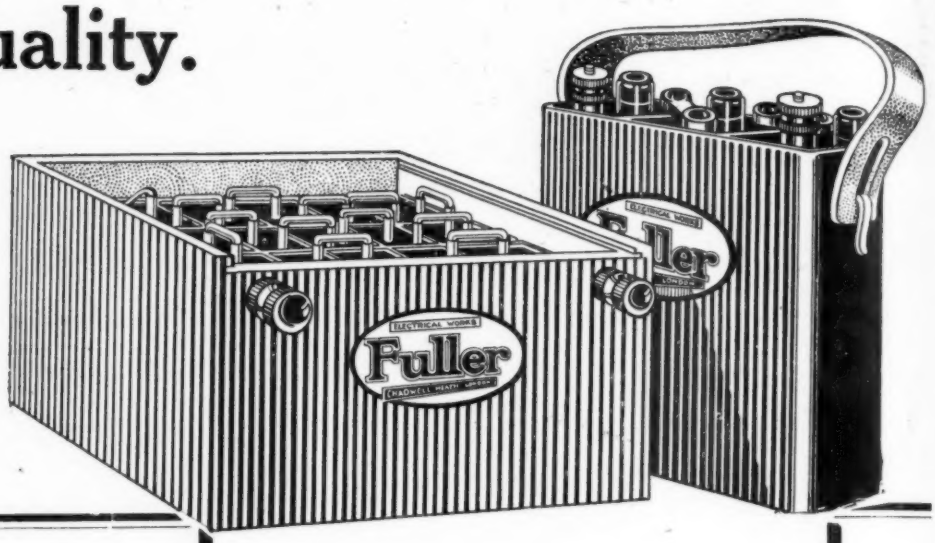

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"As a general all-round valve, I consider it without equal.

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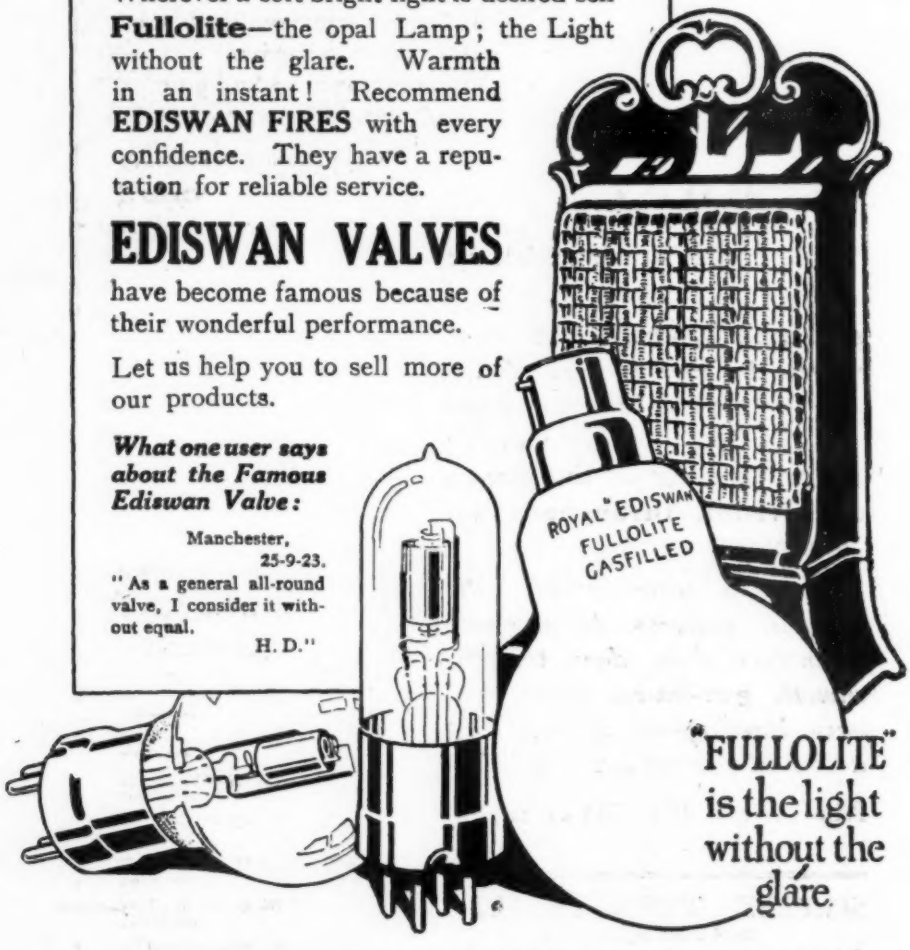

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No need to instal slip ring motors

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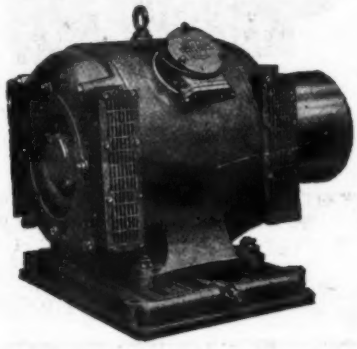

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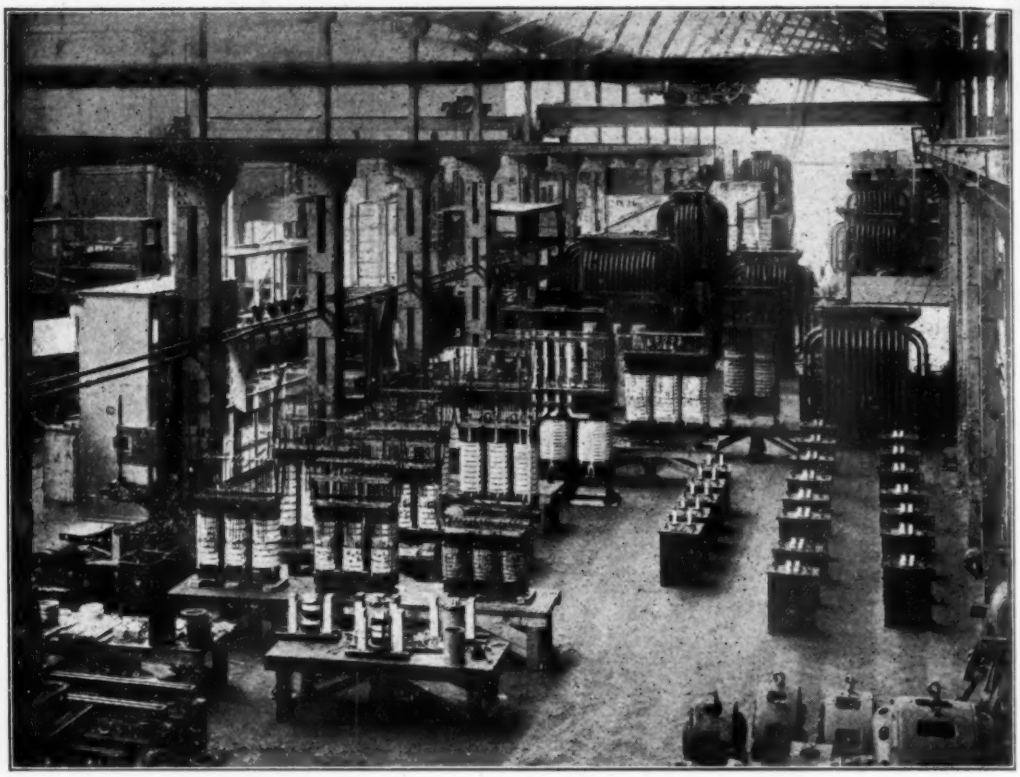

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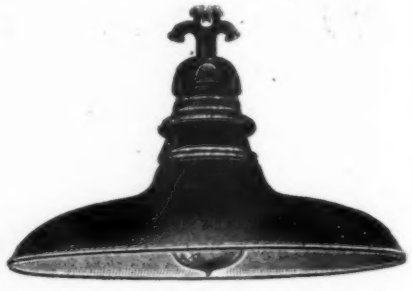

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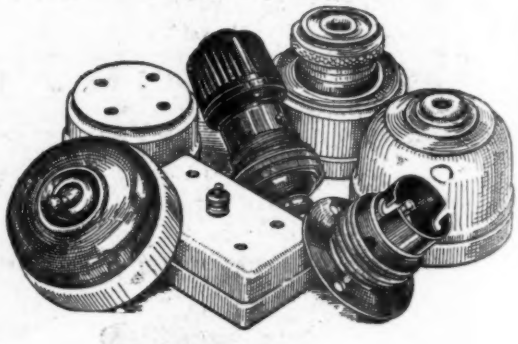

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THE same master mind which was responsible for the invention of the world-famous A-type Headphone created the **Brown** Loud Speaker.

Its design—the shape of its horn—the material selected for it—all these vital points were the result of exhaustive experiment in the quest for the ideal Loud Speaker.

Considerable expenditure of time and money were necessary before the **Brown** Loud Speaker arrived at a stage where it is above criticism. Take the metal horn, for example: comparative tests were made with horns of every shape and size fashioned out of a wide range of materials, including wood and ebonite. But none could approach the one eventually standardised upon—an aluminium horn with a thickened rim.

By stocking **Brown** Loud Speakers and Headphones you definitely ally yourself to a firm which has achieved a reputation for high-grade Radio apparatus the whole world over.

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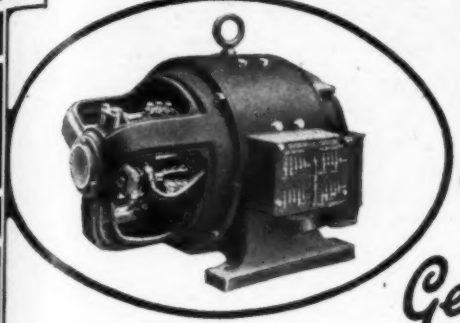
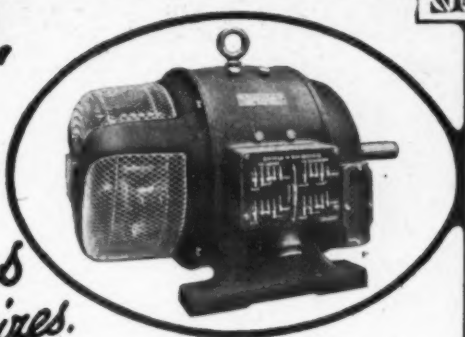


End Bracket Type.

D.C. Motors and Generators of medium sizes.



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QUALITIES:
Stability.
High Efficiency.
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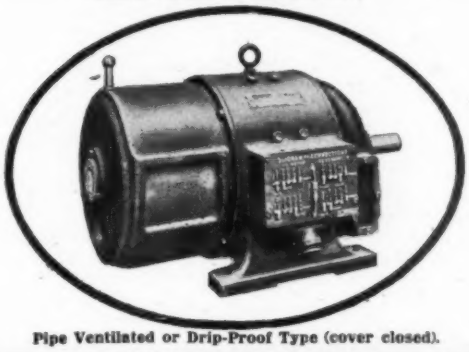
Many features not incorporated in other designs.



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EVERY DEALER will agree that a profit is a very good thing to make, but every man of experience knows that to make a good customer is a far sounder proposition.

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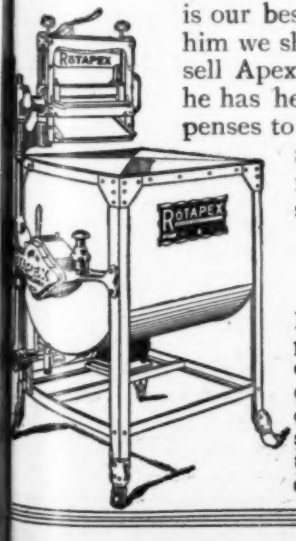
But we know that the Dealer is our best friend—without him we shouldn't be able to sell Apex at all—and that he has heavy overhead expenses to face, so our terms are always as generous as we can possibly make them.



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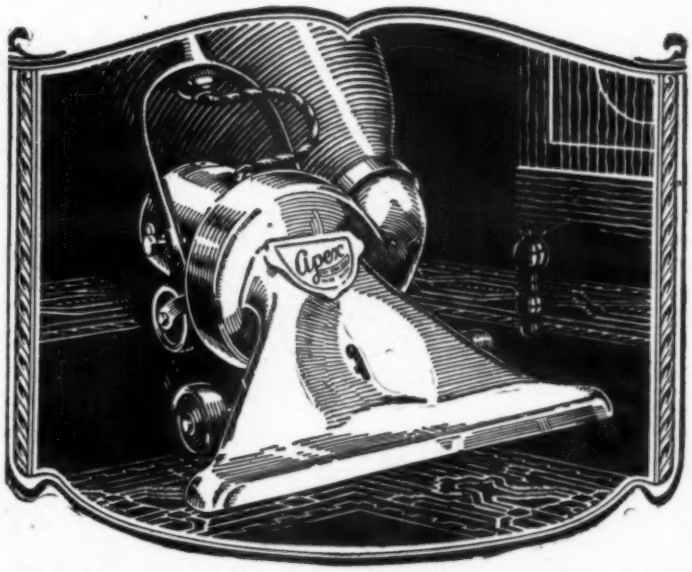
No exposed moving parts. No projections on the inside of the cylinder to tear the clothes. Specially designed wringer attached—Simple, safe, efficient.



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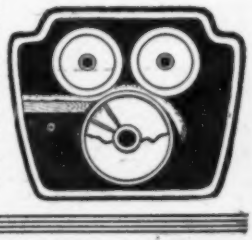
Rotapex Double Roll Home Ironer.

The perfect Home Ironer. The Rotapex will do all the ironing straight from the wringer of the Washing Machine. Two Rolls make this possible, one to dry and smooth, the other to give perfect finish. Revolving Shoe to ensure even heating.



Duncan Watson & Co., 61-62, Berners St., London, W.1, ELECTRICAL ENGINEERS. *'Phone: Museum 2000 (3 lines).*
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THE same master mind which was responsible for the invention of the world-famous A-type Headphone created the **Brown** Loud Speaker.

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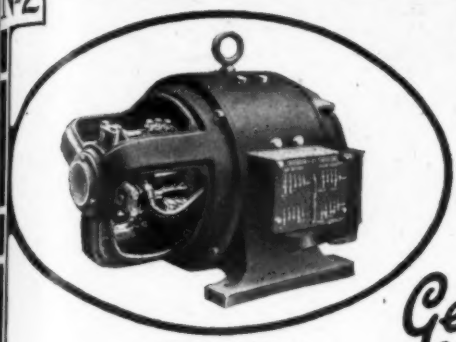

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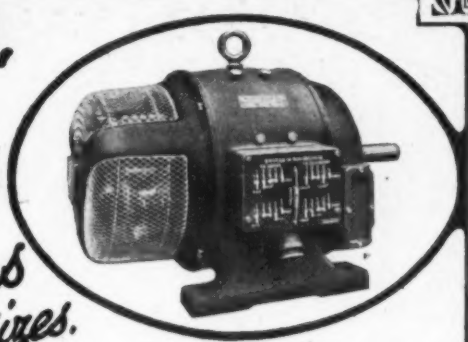

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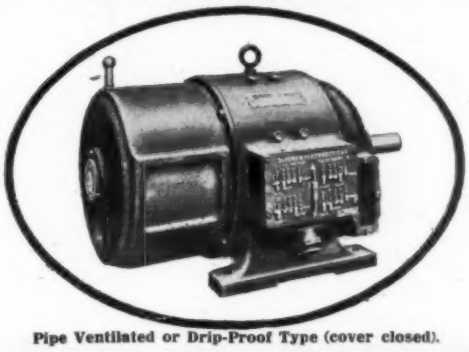

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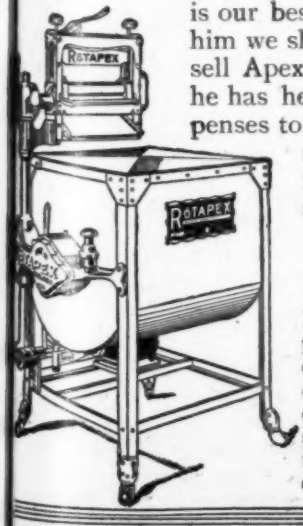

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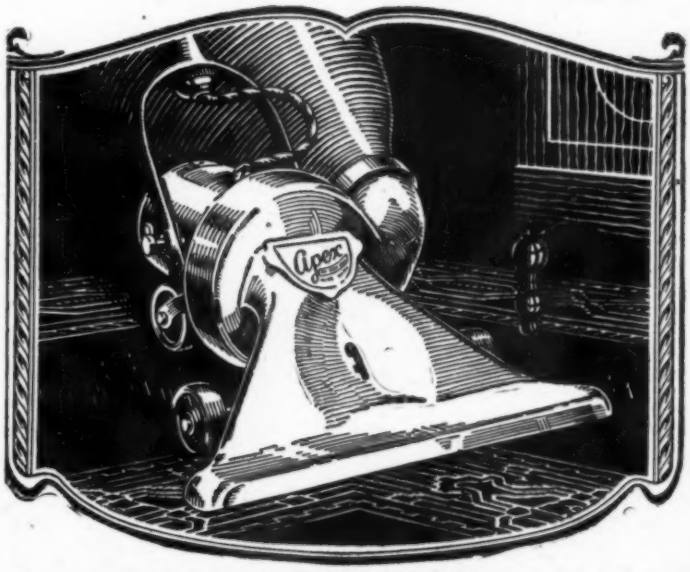

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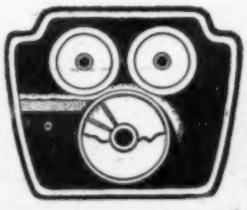

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ELECTRICAL ENGINEERS. 'Phone: Museum 2000 (3 lines).
Established over a quarter of a century.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Beach improvement scheme, including large entertainment hall (£27,200); city architect.

AYLESBURY.—Business premises, High Street, for Mac Fisheries, Ltd.

AYR.—Houses (26), for the T.C.; William Cowie, architect.

BLACKWOOD (Mon.).—Church (£10,000), for the Wesleyan trustees; the secretary.

BOURNEMOUTH.—Sunday schools, for the trustees of Holdenhurst Road Wesleyan Church (£2,000); the secretary.

BRADFORD.—Housing scheme, Lower Grange estate, Thornton Road (22 houses); city architect, Town Hall.

BRIDGWATER.—Girls' secondary school, for Somerset E.C.; the secretary.

BRISTOL.—School, Shirehampton, for the T.C.; A. F. Oaton, architect, Phœnix Chambers, 22, Clare Street.

BURTON-ON-TRENT.—Workshops and offices, for the Midland Joinery Works, Ltd.

CHATHAM.—Rebuilding 95-97, High Street, for W. H. Smith & Son, Strand, London.

CIPPENHAM (Eton).—Alterations to "King's Head," for T. Wethered and Sons, brewers.

CLOWNE (Derbyshire).—Houses (40), for the R.D.C.; J. Haslam, housing architect.

DEWSBURY.—Alteration of maternity home, Moorlands Hall; borough surveyor, Town Hall.

DUMFRIES.—Extensions to dancing hall, 36, Creswell Avenue, for Robert M'George. Workshops and offices, corner of Hood's Loaning and Leafield Road, for Hopkins & Wilson, electrical engineers.

DUNDEE.—Renovation of St. Mary Magdalene's Church (£2,000); Canon Jobberns. Dairy premises, for Dundee Pasteurised Milk Co., Ltd.; the secretary.

EARLSWOOD (Surrey).—Laundry, &c., for Reigate Board of Guardians; O. J. Porter, architect, 45, Bedford Row, London, W.C.

EDINBURGH.—Extensions at X-ray department and additions at infirmary (£50,000); the medical superintendent.

FALKIRK.—Additions to offices, for Falkirk and District United Co-operative Society (£1,100); the manager.

FARNHAM ROYAL (Bucks.).—Houses (50), for H. Boot & Sons.

FERRYHILL STATION (Co. Durham).—Nurses' home, for the Mainsforth and Ferryhill Station Nursing Association; the secretary.

FIFESHIRE.—United Free church at Windygates; the minister.

GIRVAN.—Houses (50), for the South Ayrshire Collieries, Ltd.; the secretary.

GLOSSOP.—Bakery, &c., High Street West, for the Glossop Co-operative Society; the secretary. Houses (26), for the T.C.; borough surveyor.

GUISELEY.—Premises, Guiseley Indus. Co-operative Society, Ltd., Otley Road; C.W.S., Ltd., architect's department, 1, Balloon Street, Manchester.

ILFRACOMBE.—Garage, &c., Ropery Road, for A. J. Harding, motor engineer (£5,000).

KILMARNOCK.—Women's hostel; Provost Wilson, Burgh Chambers.

KINGSTON-ON-THAMES.—Secondary school for boys (£30,000), for Surrey E.C.; W. W. Finny, secretary, Kingston.

LINCOLN.—Rebuilding premises, for Bainbridges, Ltd., drapers.

LONDON (Barnes, S.W.).—Business premises, 378, Upper Richmond Road, for R. B. Rowell. Eight houses, Clifford Avenue, for C. and E. Melville.

(East Ham, E.).—Palais de danse, for the East Ham Palais de Danse, Ltd.; W. L. Griffiths, architect, 45-46, Chandos Street, W.C.

(Eltham, S.E.).—Houses (60), Page estate, for Woolwich B.C.; borough surveyor.

(Fulham, S.W.).—Factory, Peterborough Road; London Structural Co., Ltd.

(Hammersmith, W.).—Houses and shops, Foxglove Street, Old Oak Road, and Western Avenue; Franck & Shearer. Shops and offices, Hammersmith Road; J. S. Fuller & Sons.

MELTON MOWBRAY.—Alterations to residence, Burton Lazars, for Major Clarke.

MIDDLEFORTH (Lancs.).—Church institute; A. C. M. Lillie, architect, Bamber Bridge, Preston.

PERTH.—New garage for Corporation motor 'buses; burgh surveyor. Chapel and shrine at St. John's Church; Sir Robert Lorimer, architect.

PORTSMOUTH.—Business premises, 18, High Street, Cosham, for William Miller, Ltd.

RAMSGATE.—Parish hall, for St. Ethelbert's Roman Catholic Church; Priest-in-charge.

RICHMOND-ON-THAMES.—Alterations, Boat House Hotel, Kew; E. J. Partridge, architect. Alterations, Pigeons Hotel, Petersham Road; H. G. Pelly. Additions, Royal Hospital; Brewer, Smith & Brewer, architects. Alterations, Station Hotel; J. E. Jefferson.

ROTHERHAM.—Alterations, College Square, for W. E. Taylor.

SALTBURN (Yorks.).—Conversion of premises into offices and fire station, for the U.D.C.; the surveyor.

SOUTHAMPTON.—Ship repair works, the Docks, for J. Samuel White and Co., Ltd., Cowes, I. of W.

SOUTHEND-ON-SEA.—Roman Catholic Church, Leigh; Rev. Father F. Gilbert.

STRATFORD-ON-AVON.—Garage and showrooms, Waterside, for Hayward and Ball; Osborne, Pemberton & White, architects.

SWADLINCOTE.—Rebuilding "Drum and Donkey," Station Street and Castle Road, for Alton & Co., Ltd.

TAUNTON.—Business premises, garage, and house, Bridgwater Road, for A. E. Hawkins. Social hall, St. John's Road, for Rev. A. J. Hook.

WALLINGTON.—Secondary school, for Surrey E.C. (£30,000); W. W. Finny, secretary, Kingston-on-Thames.

WATERGATE (Co. Durham).—Houses (187), for Priestman's Collieries, Ltd.; the secretary.

WIDNES (Lancs.).—Houses (20), for the T.C.; borough surveyor.

WIGAN.—Alterations, &c., 48, Market Place, for Messrs. Baker, jewellers.

WREXHAM.—18 houses, Brynycabanau Road, for General Lloyd. Houses (50), for the R.D.C.; the clerk.

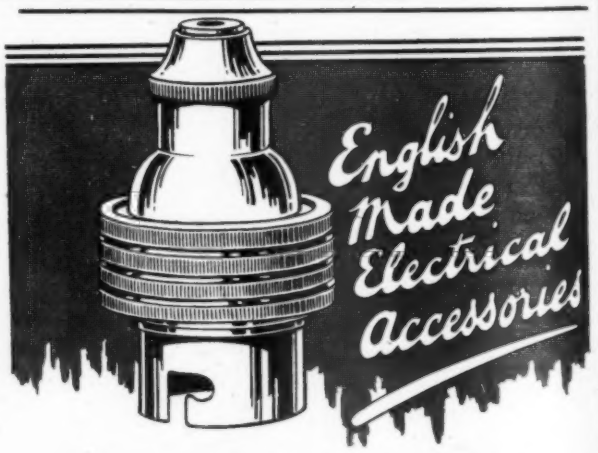
PRICE REDUCTION.

ALL "CANTIE" SWITCHES AND FUSES ARE NOW LISTED AS IN JUNE, 1914.

CANTIE SWITCH CO., LTD.

— LEIGHTON STREET —

NOTTINGHAM.



The £1000 Lamp-Holder

Bear in mind our offer to pay £1,000 to anyone who can disprove our statement that

OUR ACCESSORIES, THEIR ASSEMBLING AND PRODUCTION, IS PERFORMED IN OUR OWN WORKS BY ENGLISH LABOUR WITH ENGLISH MATERIALS THROUGHOUT.

And note also our extremely competitive prices, and you'll realise that it is absolutely unnecessary to purchase foreign-made Accessories.

Write to our Sales Representative for free Catalogue of sound English products that defy foreign competition. Why not send a postcard NOW?

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THE IDEAL COFFEE PERCOLATOR

This is the "ROWENTA," an artistic, heavily nickel-plated brass Coffee Percolator, highly polished, with a removable aluminium coffee container and strainer. It is fitted with two wicker-covered handles and best quality heating elements, and is well insulated.

The "ROWENTA" Coffee Percolator supplies a long-felt need for a really elegant and neeessary utensil for the breakfast-table. Its quality is the best obtainable.

MADE IN TWO SIZES:

No. E 9151 (110 volts and 220 volts) 4 cups.
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For further particulars and prices write for Illustrated Catalogue of

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ELECTRIC HEATING APPLIANCES

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ELECTRICAL PORCELAINS,

we have kept pace with the wonderful development of the Electrical Industry—co-operating with many of the leading designers and engineers—and producing porcelain accessories of the highest quality and efficiency for

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Established 1900. Works & Head Office: STECHFORD, BIRMINGHAM.

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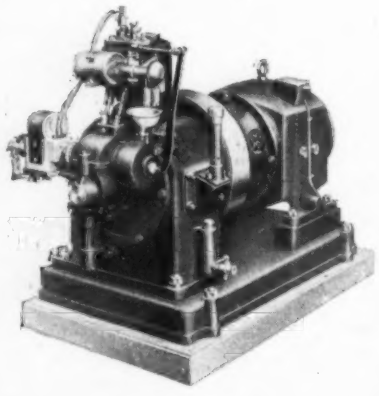

"It is a far, far better thing that I do, than I have ever done; it is a far, far better rest that I go to, than I have ever known."

THESE words, uttered by Sydney Carton on the brink of the scaffold, and immortalized by Charles Dickens, represent appropriately the thought that passes through the mind of many Electrical Contractors on installing an "R.N." Lighting Plant. An "R.N." Plant is easy to install, and its remarkable freedom from breakdown takes a load of worry off the mind of both User and Contractor, and make it a paying proposition to both.

Write to-day for List E.R. 28, illustrating all sizes from 1 to 25 KW., to the manufacturers:—

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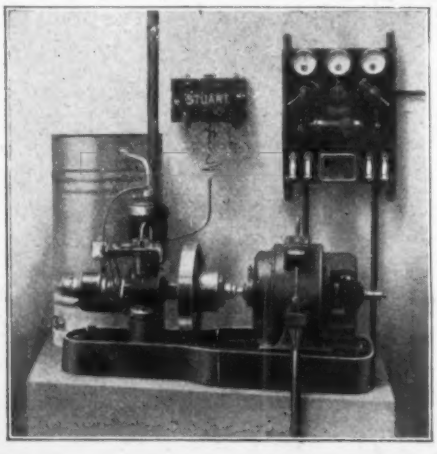

The ½ K.W. Plant

which is suitable for a house wired for 900 c.p. A pump for house water supply can be fitted. The Stuart plant is used by the Post Office, Marconi's Wireless Telegraph Co., Ltd., and other large users.

Exactly the same engine will be supplied to you in the ½ K.W. Plant.

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Other plants: 120 watts, 1½ and 3 K.W.

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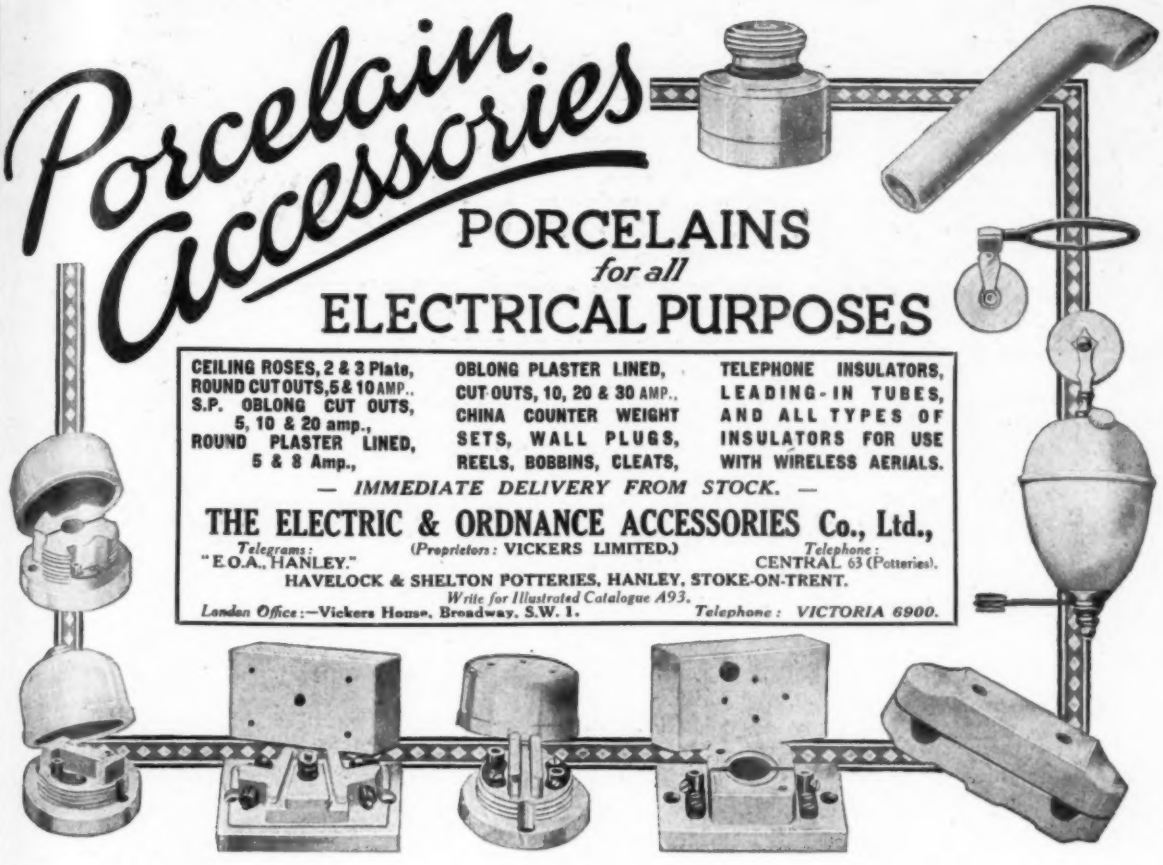

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Spacing of Pins. Diameter of Pins. Size of holes in cover only large enough to admit pins thus obviating unintentional contact.

Eventually you will be asked for them.

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The "SAX" NEW METHOD.

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1 Piece Terminal and Pin.
PERFECT SLEEVE CONTACT.
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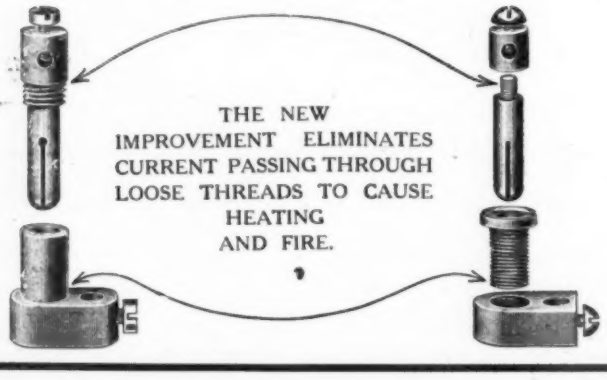

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From 1/16 to 3½ H.P., D.C.

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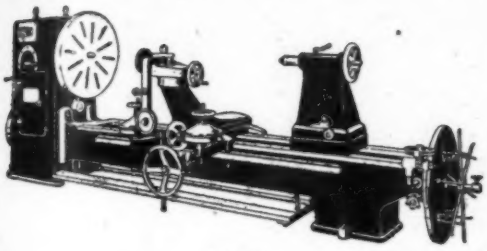

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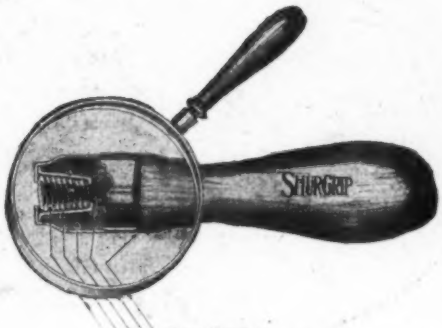

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There's a Reason—— OVER 40 YEARS' EXPERIENCE.

SAFETY WITH CONVENIENCE AND ECONOMY

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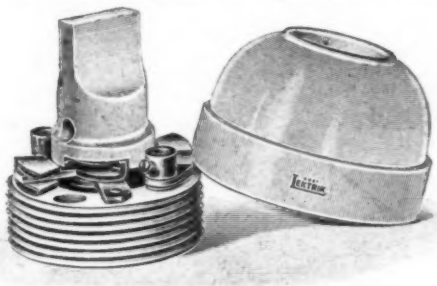
NEXT WEEK— "NEPTUNE" PUSH & PULL SWITCHES.

"IMPROVED PIONEER" SWITCHES and "IMPROVED PIONEER COMBINATIONS."

FOR SURFACE OR FLUSH FIXING.



"IMPROVED PIONEER" SWITCH.
Capacities 5 and 10 amps. Diameters 2½" and 2¾". Double Clip Contact Springs and Independent Spring Break.

The prototype of these patterns was introduced by us forty years ago, and was the first electric light switch to make use of a spiral controlling spring. Owing to its success, its then novel features were extensively copied in the Trade.

As a proof of efficient service, this type is used by many who still prefer the right-angle forward and backward thumb-key movement to other methods.

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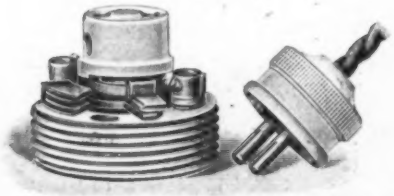

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(D.P. Switch and Two-Pin Plug Connector.)
Capacities 2·5 ("Dot") and 5 ("Universal") amps. Diameters 2½" and 2¾". Mica Insulation.

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ONE QUALITY— THE REST.

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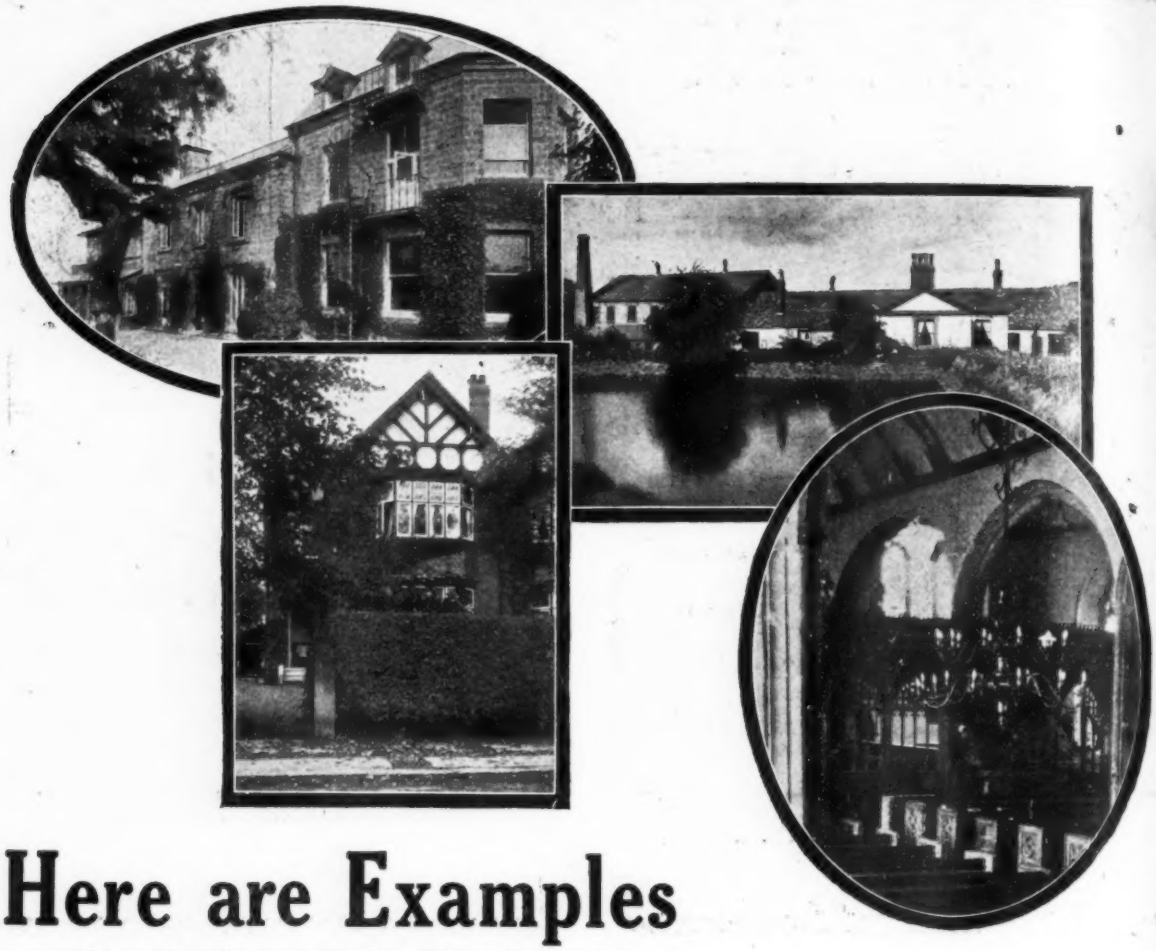
BY ROYAL WARRANT TO H.M. THE KING

QUALITY IS REMEMBERED LONG AFTER THE PRICE IS FORGOTTEN.



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of how the Macintosh Surface Wiring System is the ideal electric light installation for various types of houses. The installations were carried out by

ELECTRIC SWITCH MFG. CO., STOCKPORT.
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The beauty of the Macintosh System lies in its simplicity, its efficiency and the way in which it can be fitted without any disturbance of the existing decorations. The

Macintosh SURFACE WIRING SYSTEM

may be, in point of fact, run along picture rails, etc., in such a way as to harmonise with existing wood work and to be practically invisible. It requires no bonding and no earthing. Write for full particulars, prices and samples to any of our addresses.

THE SYSTEM.

This small diagram shows the design of the Macintosh Cable with the web between the insulated conductors, one conductor in each cable having a ribbed surface for distinguishing purposes. The cable is supported by the wooden bead or channel fastened by pins or small screws. No sag is possible.

THE

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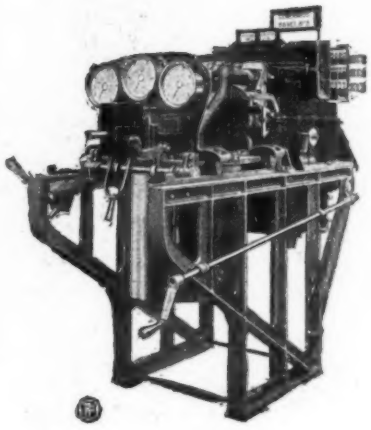

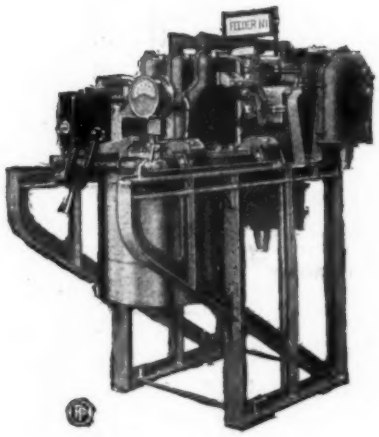

Armourclad Switchgear

Type E

for Central or Sub-Station.

300, 600, 900 amps. 12,000 volts.
1,200 amps. 6,500 volts.

SINGLE & DUPLICATE BUS-BAR UNITS.

Unit Construction
enables either single units to be used or a multiple switchboard to be built up to any requirements.

Circuit Breaker Carriage
is mounted on rollers with roller bearings, minimising wear and ensuring perfect alignment of plugs and sockets.

Circuit Breaker Contacts
are of the self-aligning finger type. Each of the two breaks per pole is fitted with substantial auxiliary break contacts for dealing with large fault currents.

Duplicate Bus-Bars
can be fitted, the change over being affected by an oil-immersed selector switch. The set of Bus-bars in circuit is indicated mechanically.

Insulation
is Bakelite throughout, no porcelain being used in any part of the unit. Substantial insulating separators are fitted between poles. All live parts are embedded in compound or immersed in oil.

Tank Construction
Strong Cylindrical Steel Tanks capable of withstanding high internal pressure, lined with insulating material of high dielectric strength.

Dimensions
Although of high rupturing capacity this type of switchgear is of comparatively small size.

No Brick or Concrete Cells required.
Proof against Vermin, Oil Vapour, Dust or Moisture.

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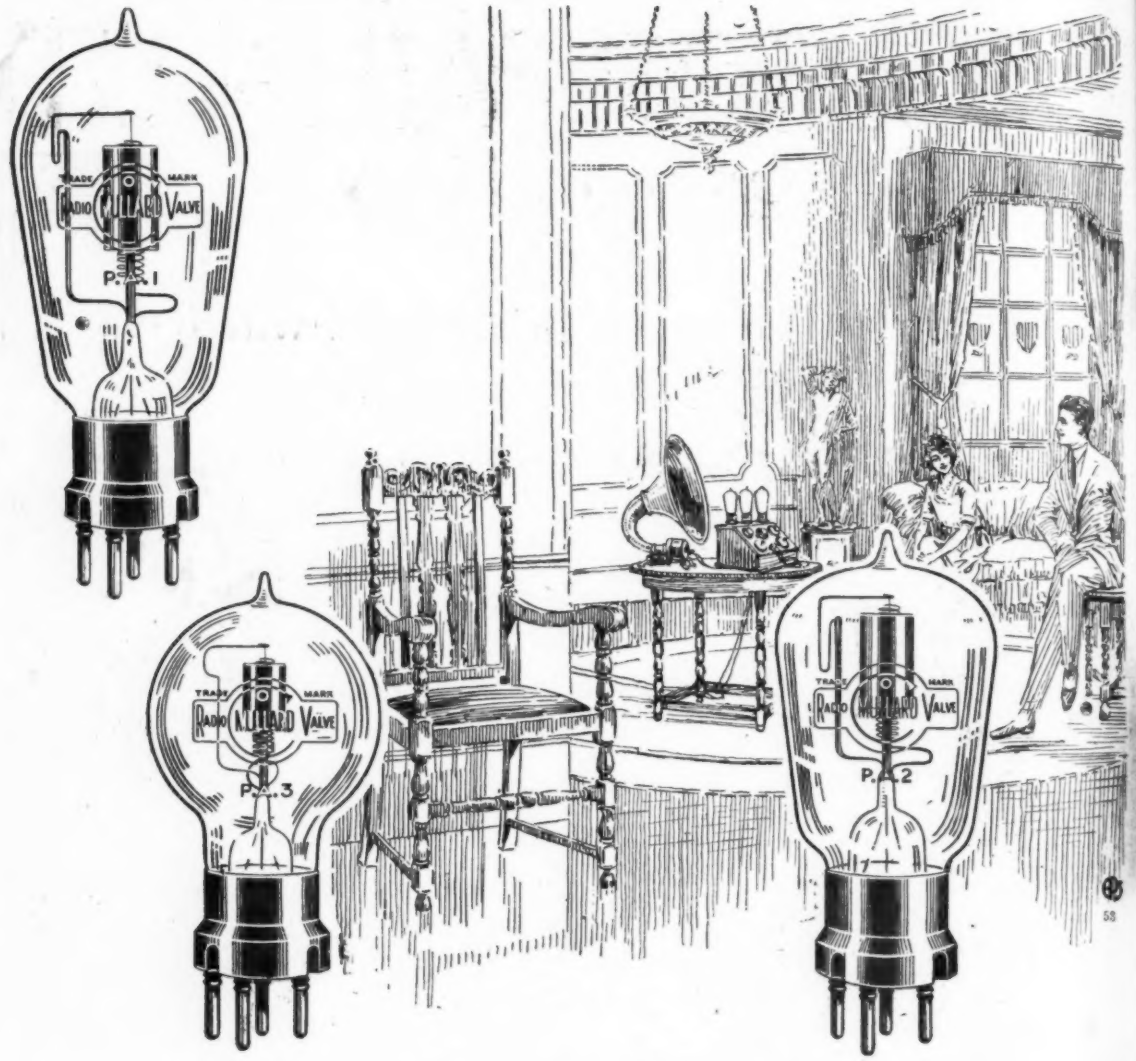

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Type P.A. 1.
For Demonstrations.
Anode volts 200—400.
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It is the last stage that counts.

Mullard P.A. Valves have been designed after long and careful investigation to operate loud speakers

Without Distortion.

Mullard P.A. Valves are made in three outputs for use with *Anode* voltages up to 400.

Your customers will appreciate them. Write to-day for List P2, giving full particulars.

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The Standard for Simplicity and Correct Design.

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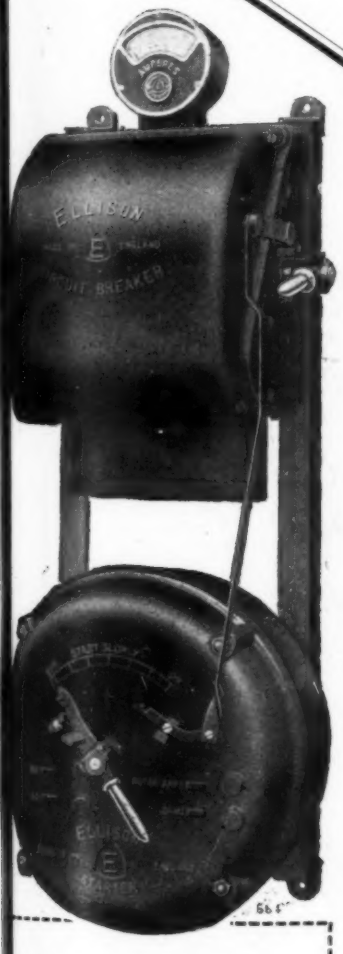
Air Break, Air Cooled

STATOR and ROTOR CONTROL PANELS

for

Slip Ring Induction Motors.



Panel for Wall Mounting.

THE Electric Control Gear literally controls the running of the plant.

It should not be loaded with "gadgets," but be made reliable, simple and accessible.

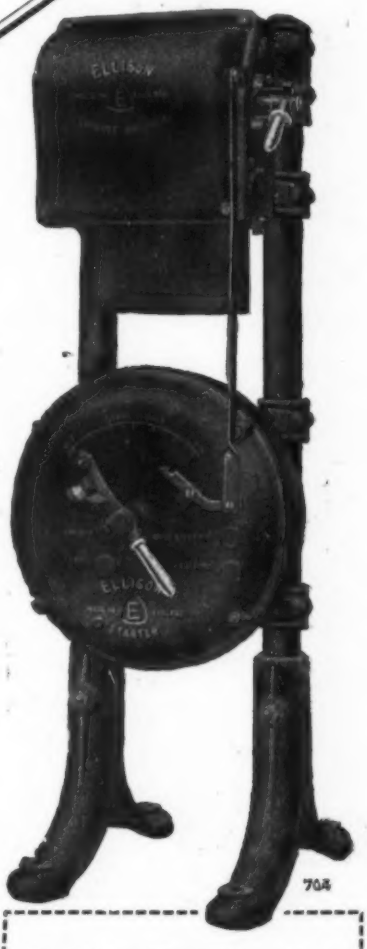
Be sure it is Ellison make.

The same principle applies to group or individual motor drives, the right gear must be selected for the control if continuity of output is to be assured. The first cost of a fuse may be lower than an automatic circuit breaker, but if it "blows" on an overload or short circuit it costs *time* to re-wire, whereas a circuit breaker can be closed again at once by merely pushing a handle.

A separate breaker and starter interlocked form the ideal apparatus for motor control. You were impressed with the new Ellison totally-enclosed circuit breaker and motor starter as individual units, now we show that they can be mounted together on a frame or stand.

This gear will please the maintenance man, for the designer had him in mind all the time.

Send for List No. 71.



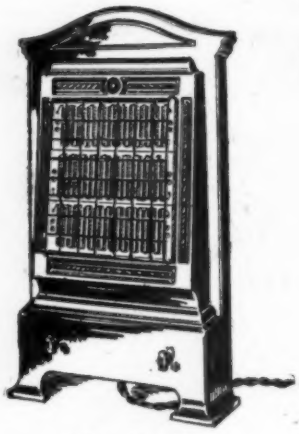
Panel for Floor Mounting.

GEORGE ELLISON,

Makers of Electric Control Gear,

WORKS: - PERRY BARR, BIRMINGHAM.

ELEMENT-ARY NOTES ON ELECTRIC FIRES.



Pattern No. EH 3.

Price: £3 10s. 0d.

PROMPT DELIVERIES AND ATTRACTIVE RESALE TERMS ARE OFFERED.

The active life and efficiency of every Electric Fire depends upon the elements with which it is fitted.

Moorwood patent corrugated elements are in a class by themselves, and possess many points of superiority over the usual coiled form of element.

Their unique form of corrugation (in a flat plane) presents a larger heat radiating surface area than is possible with any kind of coil.

Burning-out through adjacent turns touching each other, is entirely prevented.

Other advantages of these elements and a complete range of **Moorwood Electric Fires** are fully described in Catalogue No. E 5 F.86, sent free on request.

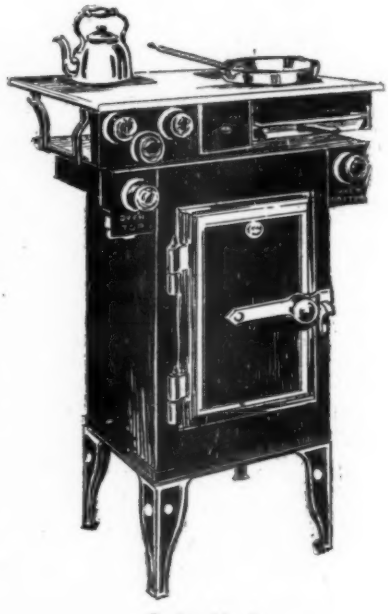
MOORWOOD ELECTRIC COOKER.

A compact, clean and convenient Cooker, comprising oven, hot plates and grill of substantial build and scientific design.

The oven is fitted with top and bottom elements, has an actual cooking space of 15" x 14¼" x 12½", and being completely insulated, all the heat generated is used for cooking the food, and not for semi-grilling the operator.

The flat formation of our patent element brings the heat parallel with, and much closer to, the utensil than has hitherto been possible.

Catalogue No. E5 C.90 (free) gives fuller particulars of this Cooker and details and prices of other **Moorwood Electric Heating Appliances.**



Cooker No. 3.

Price: £18 0s. 0d.

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For many years SIEMENS have produced Electric Lamps of high merit. The first drawn-wire metal filament lamp was placed on the market by the company in 1906, who by its introduction made themselves the pioneers of drawn-wire lamps in this country.

Today SIEMENS lamps embody the very latest developments in Electric Lamp manufacture.

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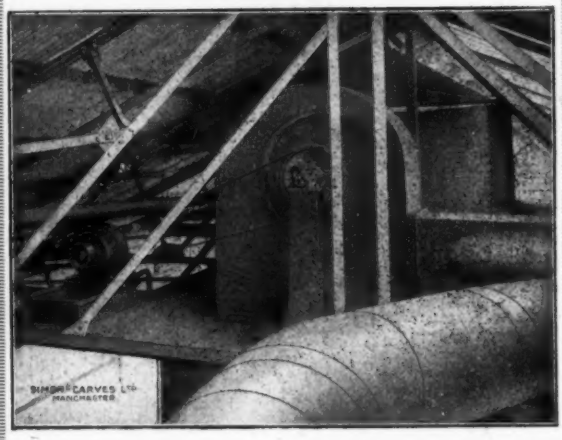
SIMON-CARVES LTD MANCHESTER

HEATING & VENTILATING

FOR

FACTORIES & WORKSHOPS



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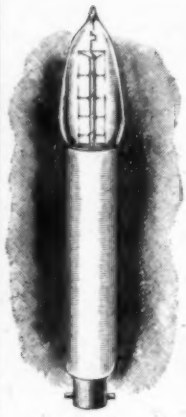

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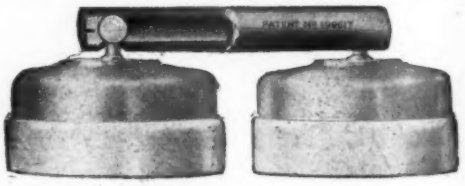

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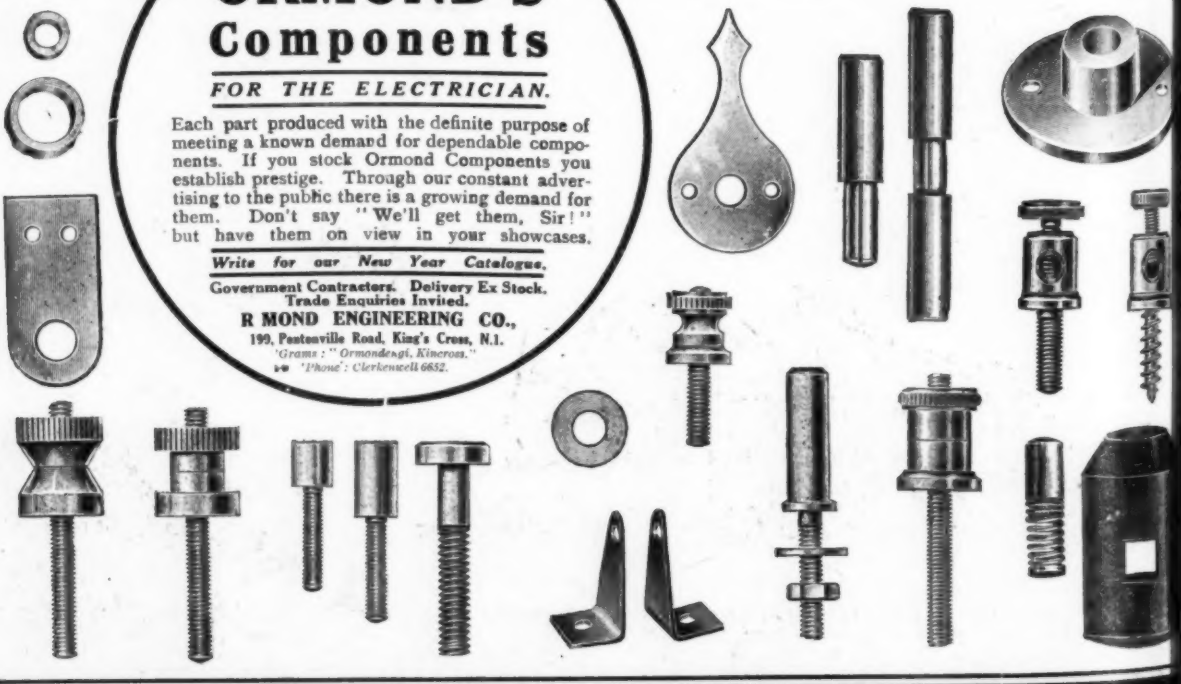

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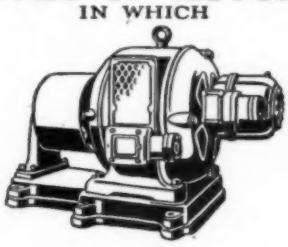

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INDEX TO ADVERTISERS.

PAGE

Abbott, Anderson & Abbott, Ltd. xviii
Accumulator Makers' Assoc. ...
Accumulators of Woking, Ltd. xv
A.C.E.C. (Ateliers de Constructions Electriques de Charleroi)
Acme Production Co. i
Adamson, D., & Co., Ltd. ...Sup. 2
Allen, West & Co., Ltd.... ...
American Hard Rubber Co., (Britain), Ltd. vi
Anti-Vibration Elec. Lamp Co. Sup. 13
Armstrong, Addison & Co. ...
Armstrong, Sir W. G., Whitworth & Co. xxii
Armstrong, Stevens & Son, Ltd. Sup. 26
Arora Co. ii
Asbestos and Mineral Corporation, Ltd.... ... ...
Ashford Dunn & Co. ... ...
Aster Eng. Co. (1913), Ltd. ... vi
Astro Electric, Ltd. ... ...
Austin & Hayes ... ... Sup. 38
Automatic Coil Winder and Elecl. Equip. Co., Ltd ...
Avery, W. & T., Ltd. xxvi

Balmford, W. ... ... Sup. 38
Barnard, H. B., & Sons ... ...
Barrett & Elers, Ltd. xiii
Bastian & Allen ... ...
Bastian Meter Co., Ltd. Sup. 36
Batteries, Ltd. ... ... Sup. 33
Belling & Co. ... ...
Benham & Sons, Ltd. ... Sup. 25
Benjamin Electric, Ltd. Sup. 27
Bennis, E., & Co., Ltd. ... ...
Berk, F. W., & Co., Ltd. Sup. 36
Berry, Wiggins & Co. ... ...
Berry's Electric, Ltd. ... ...
Bertram Thomas ... ...
Beuttell, A. W., Ltd. ... Sup. 38
Bishop, S. & C., & Co., Ltd. Sup. 38
Bliss Co., E. W. xx
Bobin (Maurice) ... ... Sup. 38
Bolton, T., & Sons, Ltd. ...
Boulton & Paul, Ltd. ... ...
Boving & Co., Ltd. ... ...
Boynton, F. E., & Co. ... ...
Braby, F., & Co., Ltd. ... ...
British Aluminium Co., Ltd. ... i & ii
British Ebonite Co., Ltd. ... xlv
British Electric Plant Co., Ltd.
British Electric Transformer Co., Ltd. ... ...
British Electrical Development Association ... ...
British Engine, Boiler, and Electrical Insurance Co., Ld. xlv
British Insulated & Helsby Cables, Ltd. ... ... Sup. 35
British L. M. Ericsson Mfg. Co., Ltd. xlix
British Mannesmann Tube Co., Ltd. xi
British Mica Co., Ltd. ... ...
British Oxygen Co., Ltd. ...
British Thomson-Houston Co., Ltd. ... ...
Brittain's Elec. Motor Co. ... i
Broadbent, T. W., Ltd.... ...
Brook, E., Ltd. ... ... Sup. 47
Brookhirst Switchgear, Ltd., ...
Brown & Co. ... ...
Brown, S. G., Ltd. ... xxviii
Browning's Electric Co. ...
Bruce Peebles & Co., Ltd. ... li
Brush Electrical Engineering Co., Ltd. ... ...
Bull Motors, Ltd.... xiii
Bullers, Ltd. ... ...
Bumsted & Chandler, Ltd. ...
Burt, Boulton & Haywood, Ltd. Sup. 14

Cable Accessories Co., Ltd. ...Sup. 7
Cable Makers' Association ...
Callender's Cable & Construction Co., Ltd. ... ...
Cambridge & Paul Instrument Co., Ltd. ... ...
Canning, W., & Co., Ltd. ...
Cantie Switch Co., Ltd. ... xxx
Capel & Co.... ... ... Sup. 36
Carron Company ... ...
Carson, F. M. ... ... i & xxiv
Century Electric Co. xlv
Chamberlain & Hookham, Ld. Sup. 37
Chloride Elec. Storage Co., Ld. Sup. 34
Churchill, Chas., & Co., Ltd. xxxv
Churton, T. Harding, & Co., Ld. i
City Electrical Co., Ltd. ...
Clarke, Chapman & Co., Ltd.... xlvii
Clifford, Charles, & Son, Ltd....
Climax Patents, Ltd. ... ...
Cohen & Armstrong ... ...
Cole, Marchent & Morley, Ltd.
Collins Electrical, Ltd.... ... ii
Concordia Elec. Wire Co., Ltd v
Condor Lamps (Gt. Britain), Ltd. ... ...Sup. 6
Connolly (Blackley), Ltd. ...Sup. 5
Consolidated Pneumatic Tool Co., Ltd. ... ...
Contract Journal ... ...
Cossor Valve Co., Ltd. ... ...
Crabtree, J. A., & Co., Ltd. ...Sup. 5
Crane, F., Chemical Co., Ltd....
Cressall Manufacturing Co. ... xxii
Credenda Conduits Co., Ltd. ... xx
Crewe, Allen & Co. ... Sup. 38
Croft Granite, Brick & Concrete Co., Ltd. ... ...
Crompton & Co., Ltd. ... ...
Crypto Electrical Co., Ltd. Sup. 45
Cryselco, Ltd. ... ...Sup. 4
Cutting Bros., Ltd. ... ...

Dacier Ltd. ... ...
Davidson & Co., Ltd. ... ...
Davis & Timmins, Ltd. ... ...

PAGE

Davis, S., & Co. ... ... Sup. 41
Dawson, E., & Co. ... ...
Daysohms... ... ... Sup. 38
Dennis, W. F., & Co. ... ...
Dermatine Co., Ltd. i
Diamond Fibre Co., Ltd. ...
Dixon (Leslie) & Co. ... ...
Donovan & Co. ... ...
Dorman & Smith, Ltd. x
Dow & Wilson ... ...
D.P. Battery Co., Ltd. ... ...
Drake & Gorham Wholesale, Ld.
Duncan Watson & Co. xxix
Dunn, H., & Son i

Edison Accumulators, Ltd. ...
Edison Swan Elec. Co., Ltd. Sup. 44
Egerton-Green, R., Ltd. Sup. 26
Electric and Ordnance Accessories Co., Ltd.... xxxiii
Electric Construction Co., Ltd. vi
Electric Fires, Ltd. iii
Electric Control, Ltd. i
Electric Heating Co. ... ...
Electric Motor and Transformer Co. xii
Electrical Alloy Co. xx
Electrical Apparatus Co., Ltd.
Electrical Conduits, Ltd. ... xxiv
Electrical Contractors' Assoc....
Electrical Power Engineering Co. (Birmingham), Ltd. ... xxxii
Electrical Utilities, Ltd. ...
Elecl. Wholesalers Federation
Electro-Mechanical Brake Co., Ltd. ... ...
Electro-Metals, Ltd. ... ...
Electromotors, Ltd. xxv
Ellison, George xxxix
Enfield Cable Works, Ltd. ...
Engineering and Lighting Equipment Co., Ltd. i
Engineering Supplies, Ltd. ...
English Electric Co., Ltd. ... xvii
Etchells, Congdon & Muir, Ltd.
Everett, Edgcumbe & Co., Ltd. xxvi
Evershed & Vignoles, Ltd. ... xxvi
Excelsior Shade Mfg. Co....Sup. 2 & 26

Fair, Walter D., & Co., Ltd.? ...
Falk, Stadelmann & Co., Ltd. Sup. 40
Farrow & Sons ... ... Sup. 14
Ferguson, Pailin, Ltd. ... xxxvii
Ferranti, Ltd. xiv
Fleming, Birkby & Goodall ... i
Fluxite, Ltd. ... ...
Foster Engineering Co., Ltd. Sup. 46
Fraser & Chalmers Eng. Works i
Fuller's United Elec. Wks., Ltd. i & Sup. 42
Fyfe, Lumsden, Ltd. ... ...

Gath Elec. Eng. Co. ix
Geipel, Wm., & Co. ... Sup. 40
General Electric Co., Ltd. i & Sup. 15, 16, 37
Gent & Co., Ltd. xi
Gillespie & Beales ... ...
Gilman, F. (B.S.T.), Ltd. Sup. 14
Gledhill Brook Time Recorders, Ltd. ... ...
Globe Engineering Co., Ltd. Sup. 36
Glover, W. T., & Co., Ltd. ...
Gordon, J., & Co., Ltd. xviii
Gourier & Levi ... ...
Graham (Alfred) & Co. ... Sup. 38
Grammont, Ets. ... ...
Green (Horace) & Co. ... ...
Greengate & Irwell Rubber Co., Ltd. ... ...
Griffiths Bros. & Co. (London), Ltd. ... ... Sup. 36
Guiterman, S., & Co., Ltd. Sup. 37

Hackbridge Electric Construction Co., Ltd. ... ... Sup. 12
Hall, J. P., & Sons ... ...
Hall, J. P., & Co., Ltd. ... Sup. 47
Hann & Ingle xxiv
Hardy & Padmore, Ltd. ...
Harris, A. E., & Co. ... Sup. 38
Harris, J. F. & G., Ltd.... Sup. 38
Hart Accumulator Co., Ltd. ...
Harwell, Ltd. ... ... Sup. 28
Haslam & Stretton (Engineering and Motor Utilities), Ltd. Sup. 39
Hay, Maryon & Co., Ltd. ... xxiv
Heathman xxiv
Henley's, W. T., Telegraph Works, Ltd. ... ... xv & xxvii
Herbert (Alfred), Ltd. vii
Hewittic Electric Co., Ltd. ... xxv
Heyes & Co., Ltd.... ... ...
Hick, Hargreaves & Co., Ltd....
Higgs Bros. ... ...
Hightensite and Ebonite Mfg. Co., Ltd. ... ... Sup. 26
Hindley, E. S., & Sons ... ...
Hobdell, Way & Co., Ltd. Sup. 28
Hodges, C., & Co., Ltd. xii
Hoffmann Mfg. Co., Ltd. ...
Hogan & Wardrop iii
Holder-Harriden, Ltd. i
Holmes, J. H., & Co. ... ...
Hooper's Telegraph and India-Rubber Works, Ltd. ... ...
Hotpoint Electric Appliance Co., Ltd. ... ...
Howden, J., & C. ... ...
Huntalite, Ltd. xliii

Igranic Electric Co., Ltd. Sup. 36
Impag xxxv
Imperial Engineering Co. ...
Improved Appliances, Ltd. ...

PAGE

India-rubber, Gutta-percha and Telegraph Works, Co., Ltd.... lii
Ingleby & Co., Ltd. i
International General Electric Co. (Inc.) ... ...
Iooo Rubber and Waterproofing Co., Ltd. ... ... Sup. 30
Isenthal & Co., Ltd. i

Jackson Electric Stove Co. ...
Jardine, J., Ltd. ... ... Sup. 39
Jeary Electrical Co., Ltd. Sup. 28
Jenkins, Robert ... ...
Jenson & Nicholson ... Sup. 31
Johnson & Phillips, Ltd. i, Sup. 8 & 9
Jones, J. D. & Co. (London), Ld. Sup. 28
Jones, S., & Co. (London), Ld. Sup. 28
Jong, A. De xiii

Key Engineering Co., Ltd. ...
Kirk (Wheatley), Price & Co. Sup. 17
Kohler Co., Ltd. ... ...

Lacy-Hulbert & Co., Ltd. ... xv
Lancashire Dynamo and Motor Co., Ltd. ... ... Sup. 45
"Lea" Recorder Co., Ltd ...
Leach, S. G., & Co., Ltd. ...
Lelios Lamp Co., Ltd. ... ...
Lister, R. A., & Co., Ltd. ... xlix
Litholite Insulators, Ltd. ... i
Liverpool Elec. Cable Co., Ltd.
London Electric Firm ... Sup. 38
London Electric Wire Co., Ltd.
Lorival Mfg. Co., (1921), Ltd. ...
Low, A., & Sons, Ltd. ... ...
L.P.S. Electrical Co. xlvii
Lundberg, A. P., & Sons ... xxxv

Macfarlane Eng. Co., Ltd Sup. 38
Macintosh Cable Co., Ltd. ... xxxvi
Macintyre, J., & Co., Ltd. ... xxxii
Mackie, W., & Co. ... ...
Malcolm & Allan, Ltd. ... ...
Marconi Wireless Telegraph Co., Ltd. ... ...
Marelli, E., & Co., Ltd.... ... xix
Marryat & Place ... ...
Marryat & Scott, Ltd. ... ...
Martelli, A.... ... ...
Mather & Platt, Ltd. xxix
Matthews & Yates, Ltd. ... ...
Mavor & Coulson, Ltd. i
May & Padmore, Ltd. ... ...
McClure & Whitfield ... ...
McConnell & Co., Ltd. ... ...
McGeoch, W., & Co., Ltd. Sup. 24
McGraw Hill Publishing Co., Ltd. ... ...
McKechnie Bros., Ltd.... ... xix
McMillan, J., & Co. ... ...
Measurement, Ltd. ... xxxiii
Medical Supply Association, Ld. Sup. 13
Metropolitan-Vickers, Ld. Sup. 10 & 11
Mica & Micanite Supplies, Ld. Sup. 28
Mica Manufacturing Co., Ltd.... xxiv
Micafil, Ltd. xxxv
Mickelwright, Ltd. ... ...
Midland Elec. Mfg. Co., Ltd. ... ix
Midland Electric Power and Installation Co.... ... ...
Mirrlees, Bickerton & Day, Ltd. ix
Mirrlees, Watson & Co., Ltd. ...
Moorwoods, Ltd. xi
Morris (Herbert), Ltd. ... ...
Morris, J. R. ... ... Sup. 36
Mosses & Mitchell iii
Moy, Ernest F., Ltd. i
Mullard Radio Valve Co., Ld. xxxviii

Nalder Bros. & Thompson, Ld. Sup. 33
Norris, A. G. ... ...
Northumbria Motors, Ltd. ...

Ormond Engineering Co. ... xlii
Osler ... ...

Parkinson, F. & A., Ltd. ...
Park Royal Eng. Works, Ltd. Sup. 45
Parmiter, Hope & Sugden, Ld....
Parsons, C. A., & Co., Ltd. Sup. 30
Parsons, C. H., Ltd. ... ...
Pass, Capper, & Son, Ltd. ...
Peebles (Bruce) & Co., Ltd. ... i
Pelican Electric, Ltd. iii
Percy, Hoather & Co. ... ...
Phillips, J., & Co.... ... ...
Pinchin, Johnson & Co., Ltd....
Plant and Supplies, Ltd. Sup. 39 & 40
Plenty & Son, Ltd. ... ...
Plumtree, J. S. ... ...
Power Equipment Co. ... ...
Power Rectifiers, Ltd. ... ...
Premier Accumulator Co., Ltd.
Premier Cooler & Eng. Co., Ltd.
Premier Electric Heaters, Ld....
Premier Gas Engine Co., Ltd.
Pritchett & Gold and E.P.S. Co., Ltd. ... ...
Pulsometer Eng. Co., Ltd. ...

Rawlplug Co. ... ...
Rayner & Heald, Ltd. ... xxxiii
Rayner, D. D., & Co. ... ...
Reader & Sons, Ltd. ... ...
Reavell & Co., Ltd. xiv
Reason Mfg. Co., Ltd. ... ...

PAGE

Record Elec. Co., Ltd. ... ...
Rees Roturbo Mfg. Co., Ltd. ...
Reeves & Co. xxx
Relay Automatic Telephone Co., Ltd. ... ...
Rentell, S., & Co., Ltd. ... Sup. 29
Reyrolle, A., & Co., Ltd.... ... xxii
Robinson (Lionel) & Co. Sup. 27
Rockliff Bros., Ltd. ... ...
Ross Courtney & Co., Ltd. ... vi
Rotax Motor Accessories, Ltd. iv
Royce, Ltd.... ... ...
Rudkin, J. B. ... ...
Russell, Newberry & Co. ... xxxii
Ruston & Hornsby, Ltd. ...
Ryman, F., & Co.... ... ...

Sample, A. A. ... ... Sup. 38
Sandycroft, Ltd. ... ...
Sankey, Joseph, & Sons, Ltd....
St. Helens Cable and Rubber Co., Ltd. i
Sax, Julius, & Co., Ltd.... i & xxxiv
Saxonia Electrical Wire Co., Ld.
Scott, A. C., & Co., Ltd. Sup. 38
Scott Insulated Wire Co., Ltd.
Seaborne Interceptor and Engineering Co., Ltd. ... ...
Shaw, J., Son, & Greenhalgh, Ltd. ... ...
Siebe, Gorman & Co., Ltd. ...
Siemens & English Electric Lamp Co., Ltd.... xli
Siemens Bros. & Co., Ltd. ... xviii
Silumite Insulator Co., Ltd. ...
Simmonds Bros., Ltd. ... ...
Simon-Carves, Ltd. xiii
Simplex Conduits, Ltd.... Sup. 6
Simpson, Baker & Co. ... ...
Sisson, W., & Co., Ltd. ... ...
Sloan Electrical Co., Ltd. Sup. 31
Sloan, J. M. ... ...
Small Elec. Motors, Ltd. ...
Small Power Dynamo & Motor Co., Ltd. xxxiv
Smith, Frederick, & Co., Ltd. vi
Smith, H. W., & Co., Ltd. ... xx
Smith, J. & W. B., Ltd.... ...
Soc. Anon. Le Transformateur
Solenoid Regulator Co. i
Spencers (Electrical), Ltd. ... xiii
Spicers, Ltd. xxiv
Spon, E. & F. N. ... ... Sup. 31
Steel Tubes and Conduit Co. ...
Stella Conduit Co., Ltd. Sup. 31
Sterling Telephone & Electric Co., Ltd. ... ...
Sterling Varnish Co xiii
Sturtevant Eng. Co., Ltd. ... xx
Sun Electrical Co., Ltd. Sup. 43
Sutcliffe Bros. & Bryce, Ltd. ... xxiv
Swedish General Electric, Ld. Sup. 43
Switchgear and Cowans, Ltd. Sup. 32

Tarmac Ltd. ... ...
Taylor & Challen, Ltd. ... ...
Taylor & Petters, Ltd. ... ... i & ii
Taylor, Tunnicliff & Co., Ltd. Sup. 29
Telegraph Condenser Co., Ld....
Telephone Mfg. Co., Ltd. ... xxi
Todman, Ryall & Co., Ltd. ...
Tucker, J. H., & Co. ... ...
Tudor Accumulator Co., Ltd. viii
Turner Bros. ... ... Sup. 30
Turner, S., Ltd. xxxi

Underwood (Mcr.), Ltd. ... xiii
Union Cable Co., Ltd. ... ...

Vandervelde, L. ... ...
Veritye Ltd. ... ... Sup. 1 & 2
Vickers, Ltd. ... ... Sup. 2
Vincent Switchgear Mfg. Co. ...
Visco Engineering Co., Ltd. ...
Vlasto, Clark & Watson ...

Wallace (Glasgow), Ltd. Sup. 35
Wallwork, H., & Co., Ltd. ...
Walsall Electrical Co., Ltd. ...
Walsall Hardware Mfg. Co., Ltd. ... ...
Walters (Austin) & Son ... ...
Ward & Goldstone, Ltd.... Sup. 42
Watliff Co. ... ... Sup. 42
Welco ... ...Sup. 42
Weir, G. & J., Ltd. ... ...
Wells, A. C., & Co. ... ...
Welsbach Light Co., Ltd. ... xx
Western Electric Co., Ltd. i and xx
Westinghouse Electric International Co. ... ...
Westminster Eng. Co., Ltd. ...
Weston Elec. Inst. Co., Ltd. ...
White Elec. Instrument Co. ...
White, Jacoby & Co., Ltd. Sup. 42
White, J. C. xl
Whitecross Co., Ltd. ... ...
Wholesale Fittings Co., Ltd. Sup. 42
Wiggin, H., & Co., Ltd. ... Sup. 42
Wiggins, F., & Sons ... Sup. 42
Wilcox (Edward) & Co.... ... ...
Wilesmith, J., & Co., Ltd. Sup. 42
Wilcox, W. H., & Co., Ltd. Sup. 42
Wolf, S., & Co., Ltd. ... ...
Worthington-Simpson, Ltd. ...
Wright Motors, Ltd. ... ...

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Accessories.
Asme Production Co.
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Bonfield, A. W., Ltd.
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Edison Swan Electric Co., Ltd.
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Batteries (Storage).
Accumulator Makers' Association.
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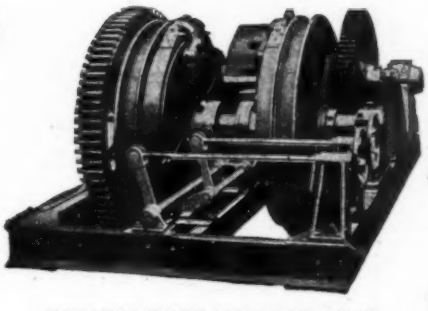

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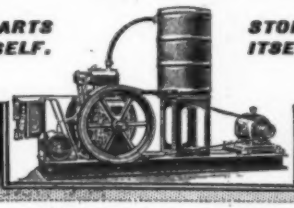

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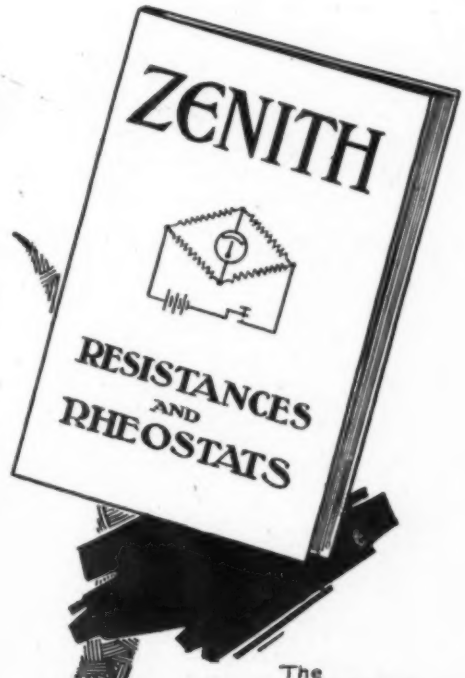

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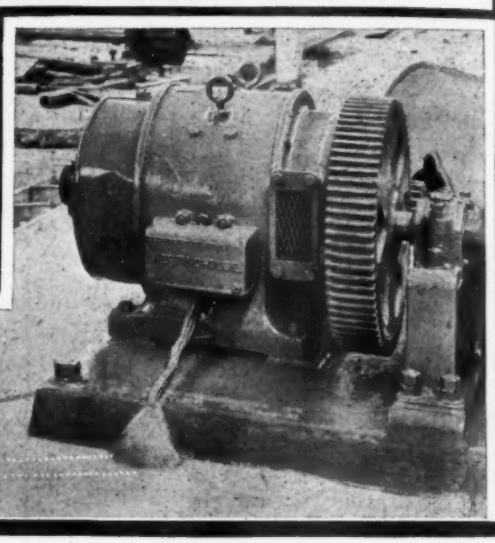

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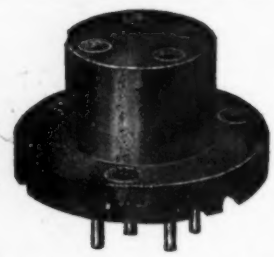

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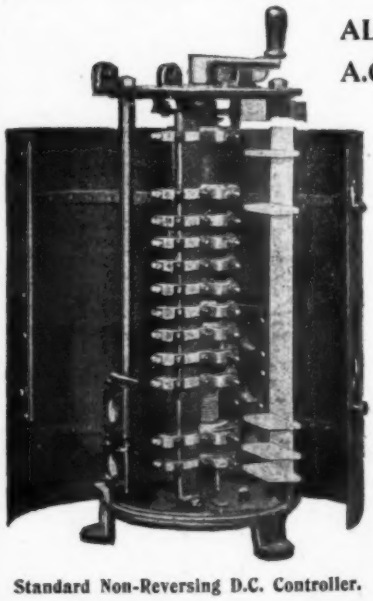

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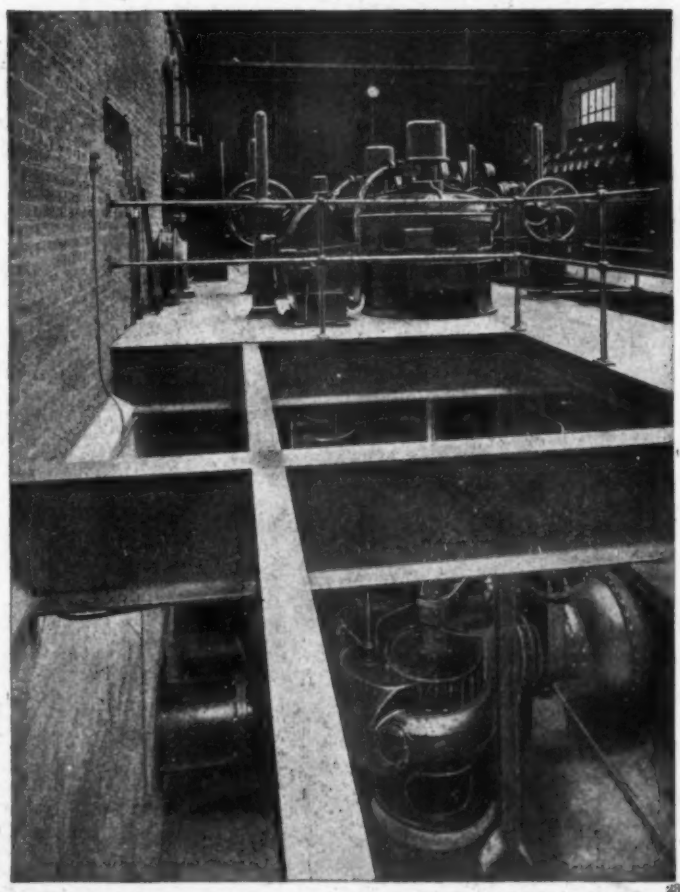

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